PORT ARTHUR FLEET: THE TRUE STORY.

SCIENTIFIC AMERICAN

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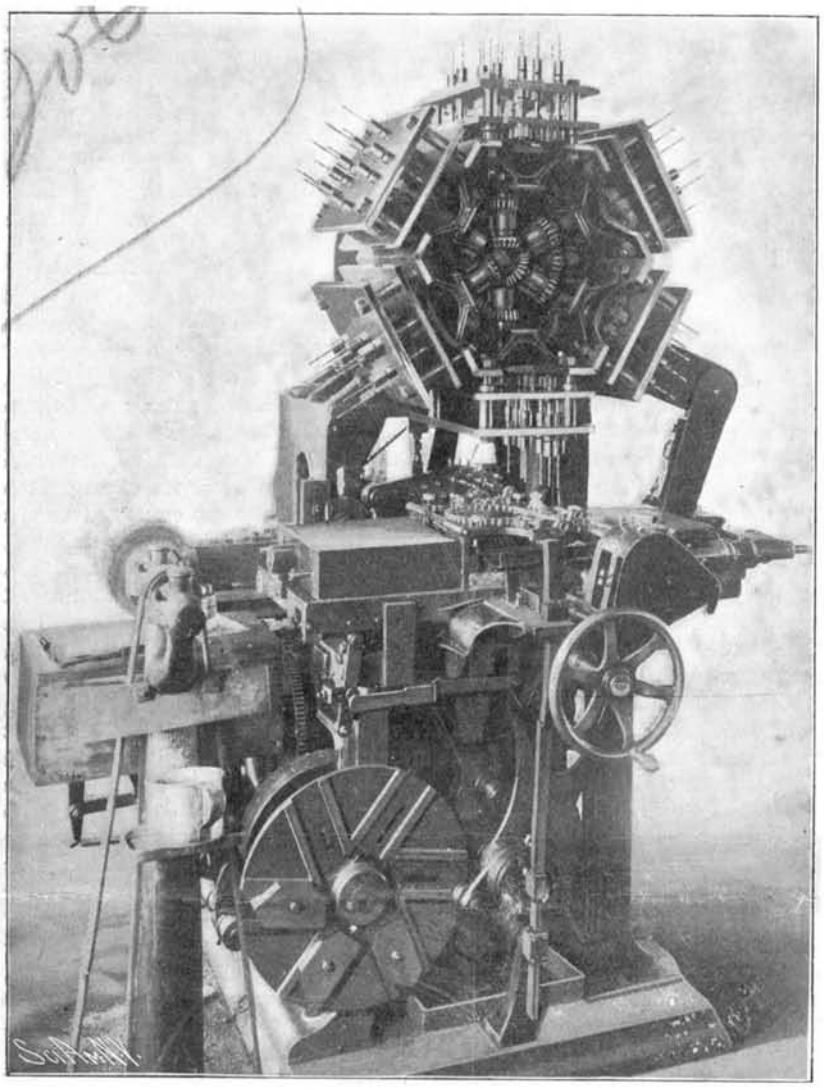

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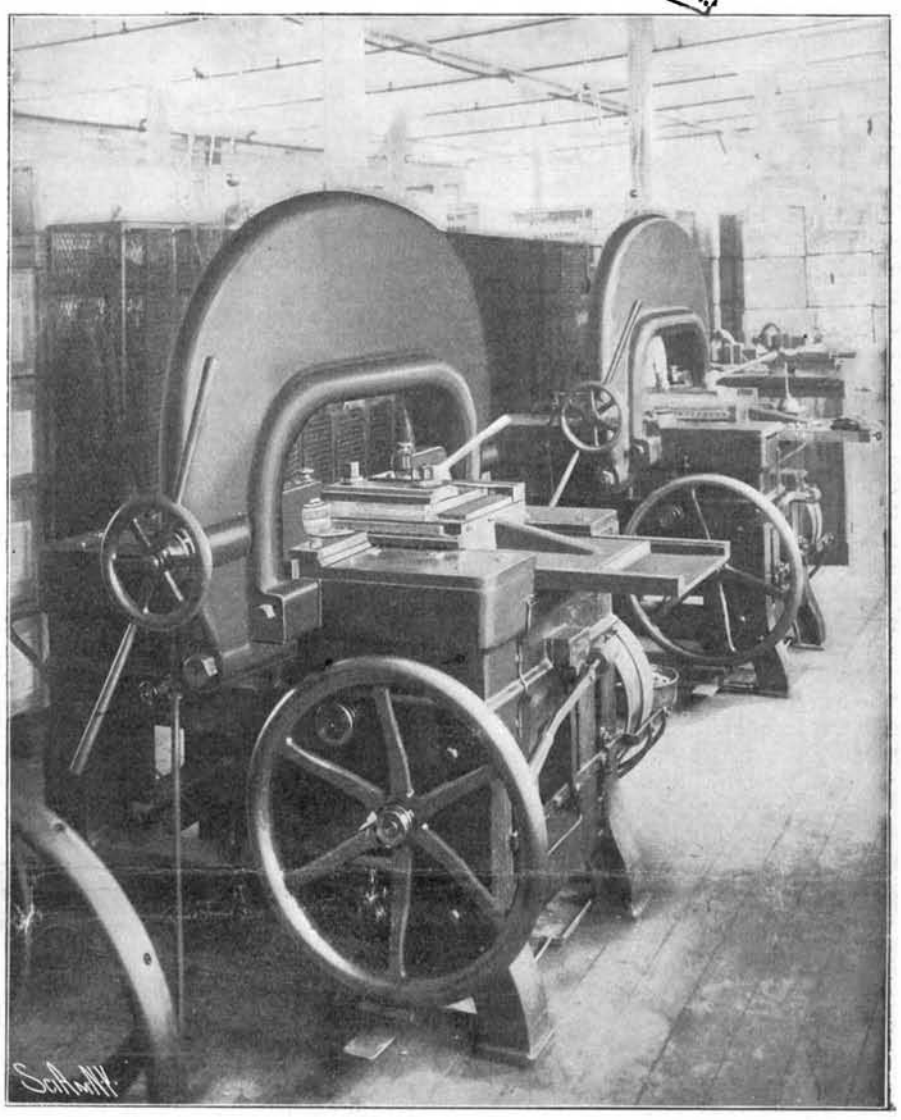

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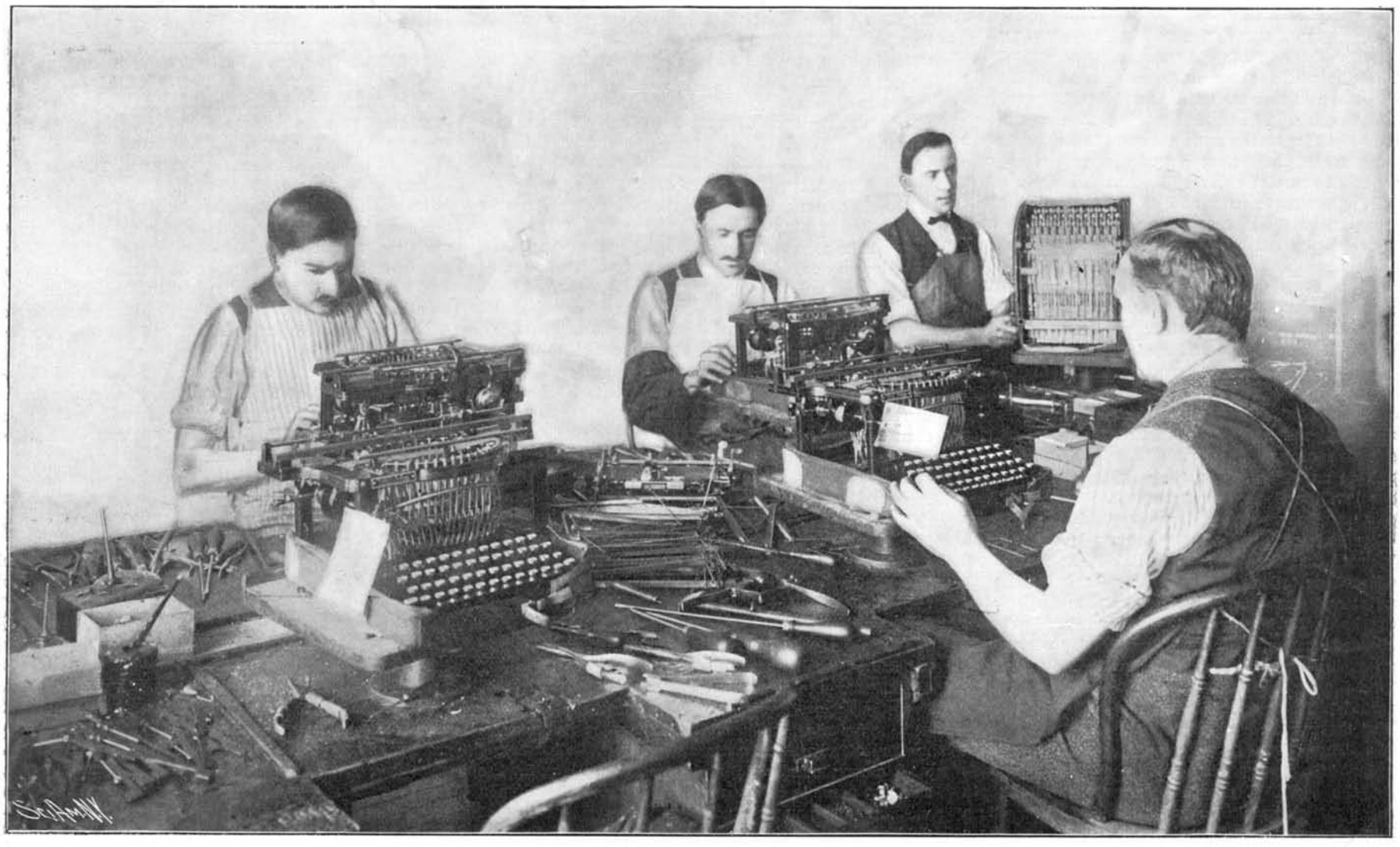
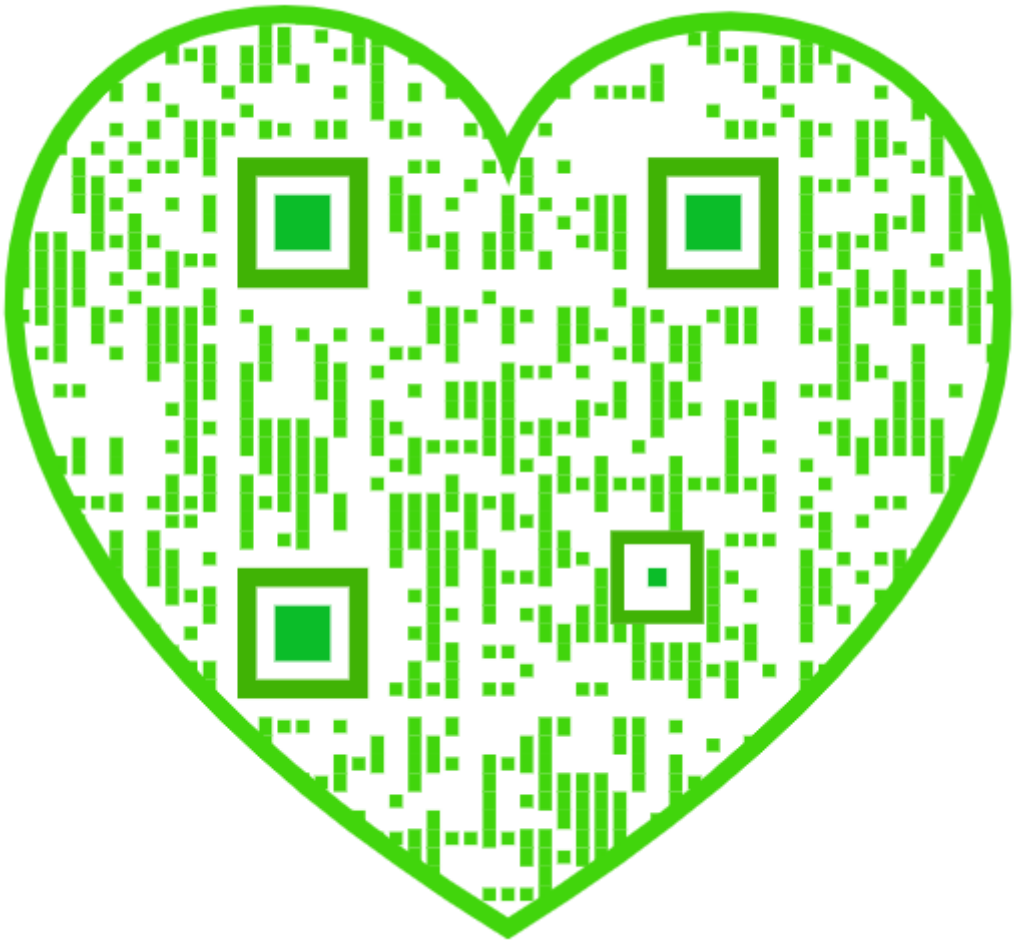


Assembling the Typewriter.—Machine Ready for Carriage.

THE MANUFACTURE OF TYPEWRITERS.—THE REMINGTON MACHINE. [See page 201.]



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NEW YORK, SATURDAY, MARCH 11, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A PORT ARTHUR MYSTERY EXPLAINED.

Thanks to the courtesy of the officers of the Port Arthur fleet, one of whom devoted a whole morning of his brief stay in New York to an interview with the Editor, we are enabled, in the present issue, to answer, in great detail, a question which was uppermost in the minds of most of us during the various operations of the Russian fleet at Port Arthur. We refer to the fact that ships which had been torpedoed or mined, and were, therefore, supposed to be out of the fight for good, would reappear, apparently in good fighting trim, in an incredibly short time after the various disasters. It was known that there was but one drydock available at Port Arthur, and that it was not large enough to admit more than one vessel at a time. By what magic then, we asked, were these awful injuries repaired, and the prognostications of experts, naval and amateur, as to the supremacy of the torpedo so rudely set at naught?

The answer to this question, as given in the article published elsewhere in this issue, will possess a fascinating interest, particularly as this is the first time that the facts have been made known to the world. Moreover, the story, coming as it does direct from some of the chief participators in that wonderful naval and military struggle at Port Arthur, is not without a touch of true dramatic interest over and above that due to its technical features. Throughout the course of the war we have recorded, either by pen or picture, every event of leading importance as it transpired; but necessarily this record has been chiefly a story of the successes of the Japanese fleet. It gives us, therefore, much pleasure to present this authentic account of the magnificent effort made by the officers and men of the Russian imperial navy to retrieve the disaster that fell upon them on that memorable night of the 8th of February, 1904.

PROPOSED MANHATTAN LOOP FOR BROOKLYN ELEVATED ROADS.

That the whole system of transportation in the city of Brooklyn is in a wretched state of inefficiency goes without saying. The tracks are rough, the cars, which are too light for their work, are poorly heated, and their motors are of insufficient power for modern requirements. The service on every line, surface or elevated, is altogether inadequate, and on every possible point of comparison the system is years behind that which can be found in many smaller cities of America that do not compare in extent and population with Brooklyn. The most important duty that the Brooklyn lines perform, or rather fail to perform, is that of getting the busy toilers to and from their work on Manhattan Island with some degree of dispatch and comfort. The B. R. T. which, being interpreted, stands for Brooklyn Rapid Transit, is a vast combination of several ill-assorted and unrelated street and elevated roads, upon which the unfortunate Brooklynite is dependent for his means of getting about. For various reasons, which do not come within the province of a technical paper like the SCIENTIFIC AMERICAN, this B. R. T. is in a state of poverty and disrepair which is a disgrace to New York city, and must be seen to be appreciated.

We said that the chief duty of the B. R. T. is to get the Brooklyn toiler to his work and back again, with comfort and dispatch. He is brought in; he is taken back; but not with comfort and dispatch. Rather is he herded, driven, loaded, and unloaded, under conditions as to space and air, and even cleanliness, which remind the writer forcibly of a certain half-hour when he stood pitifully regarding a herd of "dumb driven cattle" that were being unloaded at the Chicago stockyards. There is a saying among suburban railroad men that "the money is in the straps." Judged on this basis, the B. R. T. should be simply smothered in wealth; for at certain hours of the day a strap is a luxury so scarce on a Brooklyn car as to provoke a competition for its possession, only less strenuous than the headlong rush to secure a coveted seat.

There are many causes that contribute to this transportation fiasco. One of these is the fact that each of the two bridges across the East River is a terminus, and that there is no connection whatever between them. The trains and cars that cross to Manhattan, unload and receive their hundreds of thousands of passengers at two separate centers which are not related either to each other or to the general system of transportation on Manhattan Island. It has long been recognized that the only sensible way to prevent the useless congestion at these two terminals is to connect them by a system of tracks, and thereby form a loop around which the trains can circulate, unloading or receiving their passengers at various points on Manhattan.

Just now there is a spirited controversy as to whether this loop shall be built by way of an elevated structure or a subway. It is the laudable wish of the Rapid Transit Commission to prohibit the erection of any more elevated structures, and build all future extensions of existing roads in subways. They would prefer to connect the two bridges by a subway below Center Street. The Brooklyn cars would then cross the East River by one bridge, pass down by a four per cent grade into the Subway, and return by the other bridge, thence making the circuit of their various routes on Long Island.

To this scheme the Brooklyn Rapid Transit Company is unalterably opposed, being in favor of the connection of the bridges by an elevated structure over the same route proposed by the Rapid Transit Commission. Although it is not so stated, the B. R. T. objection is based upon the facts (well known among railroad men) that the equipment of the Brooklyn elevated roads is unsuitable for use in the Subway. The majority of the cars are too light, weighing much less than the heavy Subway cars; they are not fireproof; and their electrical outfit, motors, wiring, etc., if it used the higher tension current with which the Subway is equipped, would be liable to constant short circuits and danger of fire. On the other hand, if the B. R. T. were equipped with heavier cars to match the Subway electrical installation, it would become necessary to strengthen the whole of the Brooklyn elevated structures. Hence the use of the proposed Subway loop by the B. R. T. would necessitate an outlay altogether of from $7,000,000 to $10,000,000. Of course, the very best thing to do at present would be to build the Subway, and make the necessary improvement in the rolling stock and elevated structures of the B. R. T.; but this company is (or claims to be) so impecunious as to be quite unable to face the outlay. All things considered, we think that in the present dilemma, the suggestion made at the last meeting of the Rapid Transit Commission is worthy of at least careful consideration. It was proposed to build an elevated structure between the two bridges, with the understanding that it is to exist only for a period of five years, during which it would be leased by the B. R. T. At the end of that time the proposed Subway loop beneath the East River and through certain districts in Brooklyn will be in operation. By this time, also, it is to be hoped that the B. R. T. will have recuperated to the extent of being able to bring its equipment up to the level of that of the Rapid Transit Subway in New York.

NEW EXPERIMENTS IN TURPENTINING.

The old system of boxing southern pine trees for the production of turpentine and resin has very greatly reduced the pine timber wealth of the Southern States. Three years ago the Bureau of Forestry determined that something should be done to eliminate so destructive a method of procuring naval stores. Its three years of experiments toward this end have demonstrated that a new system of turpentining, which requires the use of earthen cups and metal gutters, not only greatly conserves the life of the timber tapped, but also gives an increased yield of resin, and therefore a greater profit than is possible by boxing. The box method and the new cup and gutter system of turpentining are fully described and illustrated in Bulletin No. 40 of the Bureau of Forestry.

While the new system is not yet in use by all turpentine operators, its application is extending as rapidly as the necessary equipment can be secured. At present there is but one company supplying the kind of cups and gutter iron required. It is hoped, since the demand for this material is very great, that in the near future the supply will be sufficiently increased to enable turpentine operators to procure the needed equipment.

While, in the work just completed, the Bureau of Forestry has performed an important service to the turpentine industry, it feels that a still more conservative method of turpentining can be found which, consistent with a maximum yield of turpentine, will inflict the smallest possible injury upon the trees. With this in view, the Bureau has begun an entirely new line of field experiments, in order to determine to what extent the wound now made in tapping the trees can be lessened.

The principal experiments now set on foot comprise the practical working of a number of different turpentine crops. One set of trees will be used to determine the best width of face to be cut on trees of different diameters.

Another set of trees will be used to demonstrate the rate in height at which weekly chipping should proceed, in order to stimulate a full flow of resin. It is believed that the weekly chipping now practised cuts away in height, at one time, too much of the living wood. At present this upward chipping amounts to about 18 inches every year, and it is thought that this can be reduced at least one-half or two-thirds. Such a saving in face height will permit a considerable increase in the number of crop years, which should give a much increased total yield of resin, as well as reduce the demand upon the area of pine forests. There will also be an economy for operators in not having to move their equipment from one set of trees to another as frequently as is the case at present.

Still another set of trees will be devoted to finding out how deep toward the center of the tree each streak should be chipped. Under the present practice, it is believed that an unnecessarily deep cut is made, thereby greatly reducing the vitality of the tree and consequently its capacity to produce resin.

WIND PRESSURE ON BRIDGES.

Referring to our recent discussion of the question of the proper amount of wind pressure to provide for in bridges, a correspondent draws our attention to the fact that no mention was made of the extra surface which is presented to the wind when a train moves onto a bridge. He asks whether this surface should not always be taken into account, and its effect provided for in calculating the wind stresses on any given span. Our correspondent is entirely right in supposing that allowance should be made for train surface, and indeed this is always done. It was not our intention, in the article referred to, to cover the whole question of wind pressure, but merely to draw attention to the fact that the unit pressure adopted has been unnecessarily large, and to give the process of reasoning by which our engineers have arrived at the lower figure which is now likely to be generally adopted. It is probable that in the early days of bridge designing, no account was taken of the great increase in the area of a bridge which takes place when a train, or even a large number of horse-drawn vehicles, is crossing a bridge. The proportion of the train surface to the bridge surface, and consequently of the strains due to each, will of course be very much larger in the shorter spans. In the longer bridges the proportion will rapidly decrease; but it can never reach a point, even in a structure of the length of the Brooklyn or the Forth bridge, at which it becomes a negligible quantity. There can be little doubt that it was the increase of surface due to the entrance of the passenger train upon the big spans of the Tay Bridge, that was the immediate cause of their being blown bodily sidewise into the river.

STUDIES OF THE FOOD VALUE OF FRUIT.

At the University of California, Prof. M. E. Jaffa has carried on, in co-operation with the U. S. Department of Agriculture, a number of investigations which have to do with the food value of fruits and nuts, the special object of this and the earlier work which it continues being to study the value of such foods when they constitute an integral part of the diet.

Nine dietary studies and 31 digestion experiments were made, part of them with persons who had lived for a number of years on a strictly fruit and nut diet, and others with university students who had been accustomed to the ordinary fare. In the majority of the dietary studies and all but one of the digestion experiments fruit and nuts constituted all or almost all of the diet. Thus, in one series of tests the daily ration consisted of apples and bananas, alone or in combination, eaten with walnuts, almonds, Brazil nuts, or pecans. In other experiments different combinations of grapes, pears, figs, walnuts, and other fruits and nuts were eaten with small quantities of milk, cereal breakfast foods, etc., the latter articles being taken simply to give a relish to the experimental dietary combinations, some of which were rather unusual.

In connection with this work the nutritive value of individual fruits and nuts was studied and many data were collected and summarized regarding the composition and energy value of these materials, an interesting feature of the work being a comparison, on a pecuniary basis, of these and some common foods as sources of protein and energy. In general, it may be said that the chief nutrients in fruit consist of sugars and other carbohydrates and in nuts of protein and fat. In other words, while both fruits and nuts furnish the body with energy, nuts furnish some building material (protein) as well. Some idea of the range may be gained from the fact that at ordinary retail prices in the United States, 10 cents expended for fresh grapes will supply the body with about 830 calories of energy, and in the case of dried apples or apricots will supply about 1,200 calories, as compared with 6,600 calories from 10

cents' worth of wheat flour. In the case of almonds this sum will supply 0.08 pound protein and about 1,100 calories of energy, and in the case of peanuts 0.28 pound protein and about 2,800 calories, while expended for cheese it would provide 0.17 pound protein and about 1,300 calories, and for flour 0.46 pound protein, as well as the large amount of energy noted above.

Although some of the dietaries showed that it is quite possible to obtain the needed protein and energy from a fruitarian diet, the majority of those studied fell below the tentative dietary standards. It is hardly just to ascribe this entirely to the form of diet since the same people might have consumed no larger quantities of nutrients on an ordinary mixed diet. The nutritive value of the fruitarian diet is perhaps most clearly shown in the case of one of these subjects, a university student, who though entirely unaccustomed to such fare gradually changed from an ordinary mixed diet to one of fruits and nuts without apparent loss of strength or health. He was then able for the eight days of the experiment to carry on his usual college duties and for a part of the time also performed heavy physical work on an exclusive fruitarian diet without material loss of weight.

The cost of the fruitarian diet per person per day varied from 18 to 46 cents, values which compare favorably with those found for an ordinary mixed diet.

Although it is undoubtedly advisable to wait until more data have been gathered before making definite statements regarding the digestibility of different fruits and nuts, enough work has been done to show that they are quite thoroughly digested and have a much higher nutritive value than is popularly attributed to them. In view of this it is certainly an error to consider nuts merely as an accessory to an already heavy meal and to regard fruit merely as something of value for its pleasant flavor or for its hygienic or medicinal virtues.

As shown by their composition and digestibility, both fruit and nuts can be favorably compared with other and more common foods. As sources of carbohydrates, fruits at ordinary prices are not expensive; and as sources of protein and fat, nuts at usual prices are reasonable foods.

In the investigations at the University of California the question of the wholesomeness of a long-continued diet of fruit and nuts is not taken up. The agreement of one food or another with any person is frequently more or less a matter of personal idiosyncrasy, but it seems fair to say that those with whom nuts and fruits agree can, if they desire, readily secure a considerable part of their nutritive material from such sources.

THE DANGERS OF DINING.

BY HUGO ERICHSEN.

Of late, food adulteration has become so common, that most of the State legislatures felt called upon to pass pure food laws, which are an effective safeguard against sophistication when enforced. But are they enforced? Is it not barely possible, in view of recent disclosures, that the position of food commissioner may afford petty politicians an opportunity for "graft"? In such a case neglect of duty would flood a State with foods that, while not positively harmful to health, are certainly not what they pretend to be. A few instances will suffice. Green tea is generally adulterated with soapstone, gypsum, China clay, indigo, turmeric, or graphite. The bulk and weight of coffee are increased by the admixture of numerous roasted grains; and some years ago letters patent were issued for the manufacture of a pressed coffee bean containing absolutely no coffee at all. Sugar and the various starches are commonly employed in the preparation of the lowest grades of cocoa and chocolate. Imitation butter consists mainly of lard, and, as might be expected, this material also enters largely into the composition of certain compounds dignified by the name of cheese. Two barrels of flour are made out of one by the addition of potato starch. The grocers of yore considered themselves pretty shrewd when they added a liberal quantity of sand to their supply of sugar. But the methods of their successors are far more subtle. And for the unsophisticated layman, it is indeed almost impossible to detect the adulteration of sugar with glucose, unless he has recourse to a chemist. Most of us have seen pickles that appeared to be preternaturally green, and, presumably, many a housewife has been filled with despair at being unable to obtain this beautiful color in "putting up" vegetables. The greening of these pickles is effected by the addition of sulphate of copper to the water in which they are boiled, a proceeding that is strongly condemned by sanitary authorities.

When sulphate of copper is indicated medicinally, however, the eating of these pickles might be a good way to introduce it into the system. Some day, in place of the druggist, we may have a dealer in medicated foods! Imagine a physician prescribing fruits preserved with salicylic acid in a case of rheumatism, or recommending milk containing formaldehyde to a patient requiring an intestinal antiseptic!

Somehow formaldehyde, in my mind, is closely associated with the lacteal fluid. I have no particular desire to slander the milkman, but presume it may be regarded as an accepted axiom that the milk sold in most of our large cities is impure. In some communities, as I know by experience, the so-called inspection of milk is a farce, and intrusted to men as a recompense for political services rather than because of efficiency.

The recent typhoid fever epidemic at Ithaca, N. Y., shows how the water supply of a whole city may be polluted. Now suppose that milk cans are rinsed out in this water, and you have an idea how the typhoid-fever germs might be transmitted to the customers of a milk route. Nor is this illustration without precedent. Several cases have been cited by authorities on the subject, in which milk was thus contaminated.

Auto-intoxication is a condition with which many persons are afflicted without knowing its precise nature.

Some folk are taken violently ill after the ingestion of strawberries, butter, peas, beans, crabs, or canned asparagus. That is to say, they cannot eat any of these articles of diet without experiencing very unpleasant consequences, although they may consume every other kind of food with impunity. Apples, although generally regarded as most wholesome, do not agree with everybody.

But the dangers arising from auto-intoxication and idiosyncrasies are not the only ones that threaten the epicure. There is always a possibility of mistaking poisonous fungi for mushrooms. It is an old saying that the best way to tell the difference between a poisonous fungus and a mushroom is to eat it—if one lives it is a mushroom, if one dies it must have been a toadstool.

It is strange yet true that some animals develop immunity with reference to certain poisons. For instance, it is a well-known fact that hares and rabbits feed upon the leaves of the deadly nightshade with impunity. In the course of time, however, a sufficient quantity of atropine is deposited in their muscular tissues to poison anyone who may use them as food. For this reason, it is advisable not to dine upon rabbits in regions in which the belladonna plant abounds.

The dangers of eating tainted meat are well illustrated by an occurrence at Middleburg, Holland, where 256 soldiers and 36 citizens were prostrated after eating meat from a cow that had been killed while afflicted with puerperal fever. Ballard, to whom we owe this report, also refers to fifteen cases of ptomaine poisoning, with one death, that were caused by the ingestion of baked pork. Ptomaines are found in many articles of food besides fish and shellfish, and their presence cannot be easily ascertained. In Arizona whole families were poisoned by eating fish, and yet the fish did not give forth any perceptible odor. Ptomaines are formed in edibles through chemical changes, and are not due to the uncleanliness of the receptacle in which the food was kept or carelessness in serving it.

At Wellback, England, 72 persons were poisoned with boiled ham that was served as a lunch, during an auction sale, by the proprietress of a neighboring hotel. Of these unfortunates, four died.

According to statistics, sausage poisoning is a rather common occurrence. By bacteriologists it is commonly ascribed to the presence of an anærobic bacillus. The toxemia partly involves the digestive tract and partly the nervous system. Kerner reported 155 cases of sausage poisoning, with 84 deaths. Most of these occurred in Wuertemburg and Baden, Germany, where the methods of curing sausages favored putrefaction. Mueller recently reported 124 cases of sausage poisoning, and stated that 6 died within 24 hours out of 48 cases that proved fatal.

Among the most recent reports concerning ptomaine poisoning, two are particularly interesting. One of these pertains to the case of Comte Lionel de Laubespin, of Paris, who died in the early part of June, 1904. The count, with a dozen other guests, including the Marquis de la Guiche, partook plentifully of duck *à la Rouenaise*. All were ill next day, but the count alone succumbed. To cook Rouenaise duck, the bird is strangled and the blood coagulates. The meat, therefore, quickly goes bad in hot weather. Inquiry revealed that in order to prevent this, some dealers inject corrosive sublimate before strangling. At about the same time, Francisco Mora-Silva, secretary of the Consulate of Ecuador at New York, died at the Roosevelt Hospital of ptomaine poisoning due to eating strawberries.

Some of the fish in the waters of Japan are said to contain an active poison, wherefore their sale is prohibited in the realm of the Mikado, for fear that they might be utilized for suicidal purposes.

Rye, while in the ear, is very subject to a disease by which the grain becomes soft and black, a condition equivalent to mortification. When eaten in this state, the corn produces the most serious consequences in those who partake of it. Pellagra, a very foul condition of the skin, in which the cuticle loses its natural character and becomes squamous or scaly, and dry, discolored, and thickened, has been traced to this source. Gangrene also not infrequently follows its ingestion. In Austria-Hungary whole villages have been afflicted in this way, and it is no uncommon sight in those countries to meet men and women who have lost part of their anatomy by eating bread prepared from diseased rye.

Some years ago Vaughan and Novy discovered a poison in decomposed dairy products which they termed tyrotoxicon. This is the toxin to which a number of cases of poisoning from cheese and ice cream have been attributed. The scientists named have also been able to isolate it from oysters that had caused illness at a church festival.

Many persons would be ready to believe that the malodorous Limburger is a menace to public health, though they would be loth to ascribe toxic effects to the cheese commonly served in aristocratic households. And yet about 300 cases of cheese poisoning have been reported to the Michigan State Board of Health alone, to say nothing of the long list that might be compiled from the sanitary records of other commonwealths.

I shall content myself with a mere mention of the fact that parasites are occasionally introduced into the gastro-intestinal tract by means of fruits and vegetables. But meat also harbors the eggs of these creatures. And there was a time when trichinosis was comparatively common, but since the government introduced obligatory meat inspection, and no pork is sold without having been subjected to microscopical examination, the disease is seldom encountered.

From the incidents mentioned it will be clear that dining is not the innocent occupation it was supposed to be, that it is, in fact, attended by some risk. And I can vividly imagine the effect produced by the perusal of this essay upon the average reader. Possibly he may feel as did Wolsey when Henry VIII. said to him, according to one Shakespeare:

"Read o'er this; and, after, this:
And then to breakfast with what appetite you have!"

But, fortunately for mankind, every bullet does not find its mark, and the chances of dying of ptomaine or tyrotoxicon poisoning are not any greater than those of perishing in a railway accident or being struck by a brick falling off a roof. We may, therefore, indulge in a certain fatalism, and continue to enjoy our meals as long as we have anything to eat and are blessed with a good appetite.

NEW COMPOUND FORMED IN ELECTRIC FURNACE.

A new compound, the boride of manganese, has been recently formed in the electric furnace by M. Binet de Jassoneix, of Paris. The method of obtaining this body is described in a paper read before the Académie des Sciences. Amorphous boron reduces a considerable number of metallic oxides. With the oxides of iron, nickel, and cobalt it gives a metallic mass from which crystallized borides of these metals can be separated, as M. Moissan has already shown. Troost and Hautefeuille have prepared a boride of manganese, $Mn B_2$, containing 28 per cent of boron. The oxides of manganese are reduced by boron in an air furnace, but it is difficult to obtain a metallic mass. In the electric furnace where the temperature is higher, the boric acid which is formed is volatilized, and a melted mass containing boron and manganese is formed. The present experiments were carried out by placing a carbon trough in the furnace, containing a compressed mixture of oxide of manganese and boron. This is reduced in a few seconds. When the manganese is in excess, the metallic mass may contain 97 per cent of the latter, and takes the file easily. With an excess of boron, on the contrary, we obtain a hard and granular mass containing some 20 per cent of boron. These metallic masses are attacked by acids and burn with incandescence in chlorine, but the action stops at once in the latter case and the melted chloride of manganese protects the residue from further action. This residue contains the new compound, boride of manganese, which is separated by washing with water and alcohol. It is a brilliant metallic powder, formed of small broken crystals. Its density is 6.2 at 15 deg. C. In fluorine gas it burns with a flame, and in chlorine with incandescence. When heated in oxygen it glows brightly and forms a fusible borate. It is attacked slowly by cold water giving off hydrogen and forming manganic hydrate. Hydrochloric acid dissolves it, and forms a gas which burns with a green flame. The author analyzed the compound, and finds that it corresponds to the formula Mn B. It is to be placed in the series of definite and crystalline borides of iron, nickel, and cobalt which M. Moissan has already formed.

NEW SUN SPOTS.

Another group of sun spots has appeared on the eastern meridian. They cover an area of possibly 3,000,000,000 square miles and are more active than the great spots which appeared last month, and which are breaking up and disappearing beyond the central meridian.

These new spots are likely to cause disturbances of some importance in the atmospheric conditions later, but it is too early to predict positively as to that.

A ROLLING ROAD FOR HORSES AND WAGONS.

BY ARTHUR B. WEEKS.

A novelty in the way of transportation has been recently put in service at Cleveland. In that city most of the freight houses, coal yards, lumber yards, and many manufacturing plants are located in the flats along the Cuyahoga River, while the city at large is on a level 65 feet higher. A vast amount of teaming is done from the flats, wagons following a roundabout course up the various hills, and carrying much lighter loads than the same horses could easily pull on the level.

It requires thirty minutes to an hour to make the climb, the strain on horses and wear and tear on vehicles and equipment being excessive. A rolling road was designed by Col. Isaac D. Smead, of Cincinnati, to obviate this. It is probably the first of its kind in the world, and was built at a cost, exclusive of preliminary models and designs, in the neighborhood of $100,000.

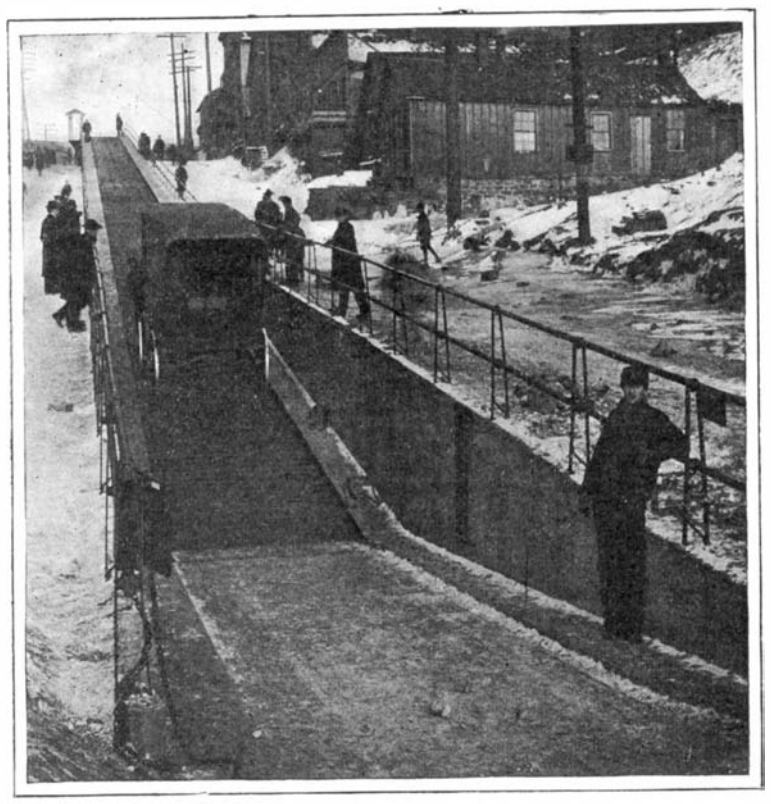
The rolling road is located on the shortest and most direct line from the flats, with a rise of 65 feet in 420 feet. It consists of an endless belt and platform made of planks eight feet long placed transversely of the roadway and bound with angle irons. They are securely fastened together in trucks of two planks each, adjoining trucks being connected by heavy links to form the continuous roadway.

The roadway runs on some four thousand small wheels in which, to reduce friction and wear, a special type of Hyatt roller bearing was successfully introduced. At the upper end the roadway revolves around an immense sheave, the returning belt running underneath (and wrong side up) on idlers to a similar sheave at the lower end.

Loaded wagons drive on the roadway at the foot of the hill, the wheels being securely clamped to prevent backward sliding. After a signal has been given to the operator in the controller house at the top, the road is started, horses and wagon remaining stationary on it till the top is reached. At the summit the roadway again slows down, and the wagons drive off.

The unconcern with which horses make the trip is surprising. They are seldom alarmed even for the first time, and after two or three rides take it quite as a matter of course. The rolling road attains a maximum speed of three miles per hour, and is driven by four electric motors placed at regular intervals along its length, operated by a single controller. As the belt is endless and can be stopped at any point (and as frequently as desired) several wagons can be handled at once; indeed, it is somewhat in the nature of a "continuous performance," one driving on at the bottom at the same time one goes off at the top, others standing meanwhile at various points along the road. As many as six wagons have been on the road at one time, and single loads weighing 18,000 pounds (including weight of wagon and horses) have been handled simultaneously with others almost as heavy.

The average time for a wagon from bottom to top, including stops made for others to get on and off, is from three to four minutes.



THE ROLLING ROADWAY IN OPERATION.

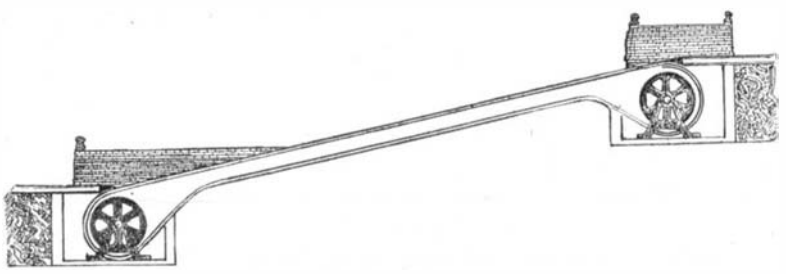


DIAGRAM SHOWING CONSTRUCTION OF THE ROLLING ROADWAY.

CURIOUS EFFECTS OF DAMAGE BY ICE.

The illustrations exhibit clearly the effect of cold winter weather during last February, and its attendant ice conditions combined with the successive rising and falling of tides in raising, by degrees, the piles supporting buildings and bridges located by fishing clubs in Jamaica Bay in New York city.

The extreme cold weather freezes the salt water around the pile between the ebb and flood tides, sufficiently to clench the pile as if it was in a vise. Then as the tide rises two or three feet, the ice coating raises the pile out of the mud bottom. As the tide falls, the weight of the surrounding ice causes the ice in contact with the pile to break off. Another cold spell freezes the water around the pile, repeating with the recurrence of the tide the same operation.

It will be noticed that it is only where the supported weight is light that the piles have been pushed up, such as the small bridge and the front piazza of one of the buildings.

All of the piles under the main buildings, where the heaviest weight is, remain intact. This is due to the fact that the weight is sufficient to overbalance the clinging force of the ice on the surface of the pile.

Long-Distance Electric Railroad.

A project is on foot for building a line of electric railroad in Switzerland and North Italy which will be the longest in Europe, having nearly 100 miles length. It is designed to give a better communication between the cities in the northern part of Italy, especially Turin, and Switzerland. The line will run through a mountainous region and will have very heavy grades. It starts from Martigny in the Rhone Valley and crosses the great St. Bernard by the Col de Ferret. The line will be completed by a section running from Turin to Savona, which is one of the leading Italian ports. The road will be standard gage, with 100-pound rails, and double track throughout. It will give a direct transfer from the other railroads at the connecting points of Martigny and Turin, and will thus afford a through connection between Central Europe and the port of Savona. Current will be supplied by hydraulic power from the Doire and the Drause rivers. Electric trains will be greatly appreciated as there will be 25 miles of tunnel on the line. The profile consists of a series of up and down grades following the valleys and mountains of this region. Electric locomotives will probably be used, as they can take a heavy train in proportion to their weight. Thus the Valtelline locomotives draw a load of 300 tons, while a motor car weighing 60 tons only takes a load of 100 tons. It is not probable that the snow will hinder the operation of the road. As to the current, it is found that 6,000 volts can be used on the Valtelline road. A locomotive of 2,000 horse-power may be employed on the new line. With polyphase motors, a recuperation of 40 per cent can be obtained on the down grade by coupling the motors as dynamos. There will likely be two trains going up grade and two descending at the same time. The hydraulic station will need to give 15,000 horse-power, using 3 units of 6,000 horse-power each. The four trains running at the same time (counting the recuperation of energy) will probably take 6,000 horse-power only. On account of the heavy grades, the trains will not exceed a speed of 25 miles an hour over 20 miles of the road, but this will be made up in the other parts, giving an average speed of 30 miles an hour.

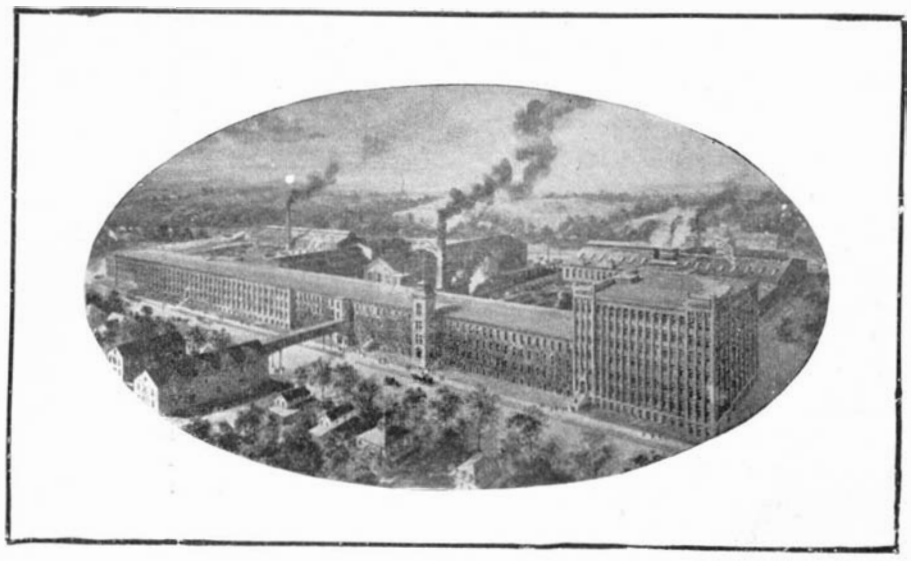
Too Much of a Good Thing.

An old writer says: "When men lived in houses of reed, they had constitutions of oak; when they lived in houses of oak, they had constitutions of reeds." This is a very fine, picturesque description of the injury which may come to us from fine houses too closely sealed to keep out the fresh air, and too heavily curtained, preventing the entrance of sunshine, which is almost or quite as important as air. But it is not at all necessary to have our fine houses unhealthful, and it only requires intelligence and thoughtfulness to render a house of oak as promotent of health as a cabin. Fresh air will come into a well ventilated oaken house as well as through the open cracks in a house of reeds, and sunlight through a window in a palace as well as in a hovel.—Health.

The heating properties of a special coal, says the Engineering and Mining Journal, depend mainly upon the carbon content, the oxygen being usually of no value, because it is combined with hydrogen as water. In gas coals, however, the excess of hydrogen is a material factor in heat production.

Photograph by E. Muller.

THE UPLIFTING OF BUILDING FOUNDATIONS BY ICE IN JAMAICA BAY, NEW YORK.



The Plant.—Reduced from a Water-Color Drawing.

The Finished Machines.

A TYPEWRITER A MINUTE.

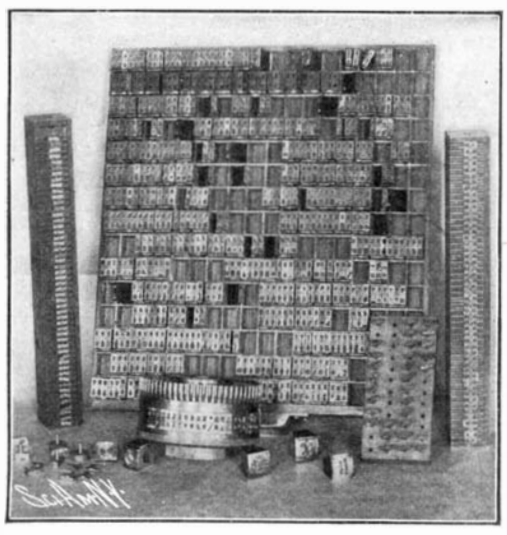
It is a far cry from the monkish calligrapher, working in his cell or the "scriptorium" in silence, to the brisk "click, click" of the modern writing machine, which in a quarter of a century has revolutionized and reformed business. The typewriter seems to have entered all arenas, until now even the sermon is apt to be transcribed on a machine. Its introduction marks an era of progress not inferior to that brought about by the telegraph and telephone.

In its economic aspect it has not only made a new vocation—especially for women—but has also enormously increased the potentiality of production. Such results are the direct product of American invention; without this invention the result would have been barren; and without the enormously clever machinery, mostly automatic—also of native growth—it would have been impossible. A typewriter of the kind we are describing consists of many hundred assembled parts, all of which must pulsate in unison, and when they are produced at the rate of one a minute, it is a twentieth century marvel. With a revolver this is easily understandable, although remarkable; but with parts which originate in foundry, forge shop, machine shops, tin shops, rubber factory, glass works, and the shops devoted to the dozen and one other allied industries, the results are extraordinary, and presuppose a perfect organization and mechanical equipment, coupled with the best skilled labor attainable. A typewriter is a most complex machine intended for performing for a period of years the duty of the amanuensis, and if it is not made with accuracy, the net result is a failure. Parts are gathered together, inspected, assembled, and finished in detail, and finally the completed machines are turned over to the shipping department, at a rate which would seem almost too large to credit. It is only by a very close application to the laws of supply and demand and the rules governing costs that such a result is achieved.

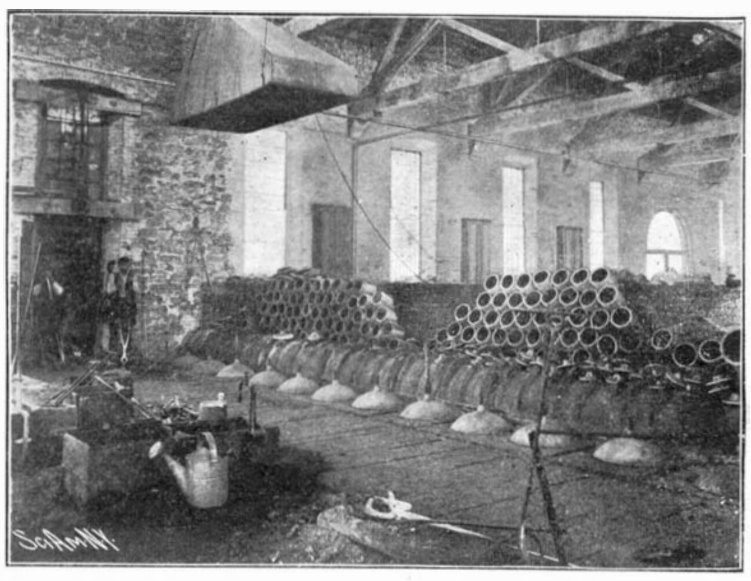
Pneumatic Molding Machine.

It is particularly appropriate that in this journal of scientific and industrial progress should appear the first published description of the great Remington

Making Coiled Springs.

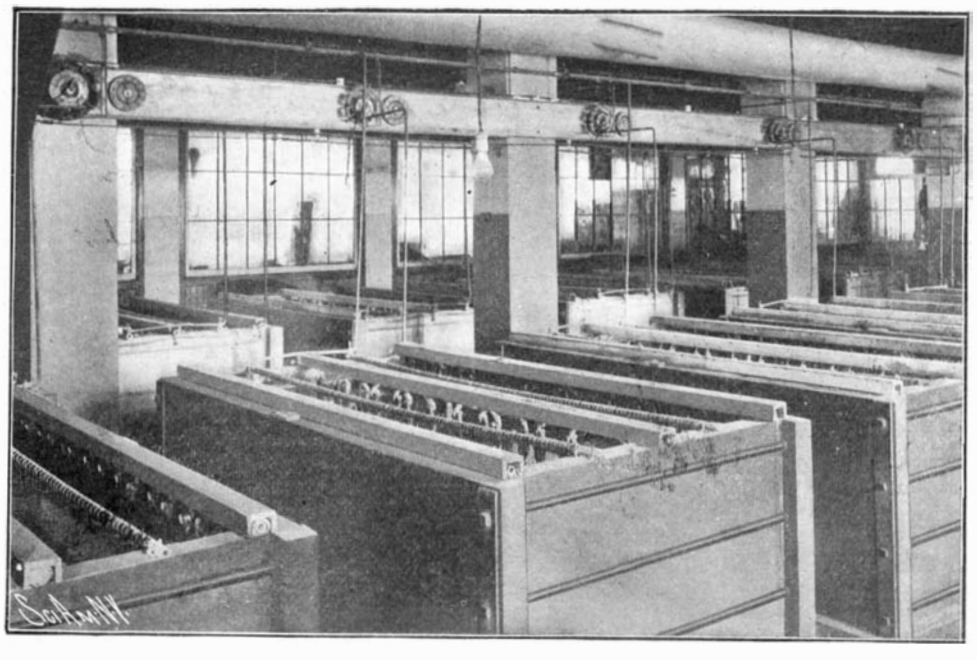


Blanks, Dies, Type.



A Corner of the Brass Foundry.

Wiring Articles for Plating.



The Plating Tanks.

THE MANUFACTURE OF TYPEWRITERS.—THE REMINGTON MACHINE.

standard typewriter factory; for it was an editorial, published in the Scientific American during the year 1867, describing the "pterotype" (winged type), a machine invented by one John Pratt, of Centre, Ala., and pointing out the great benefit to mankind and profit to the successful inventor that such a machine would confer, which encouraged C. Latham Sholes, a Milwaukee printer, and Carlos Glidden, an Ohio ironmonger, to adapt a contrivance of their own for writing figures to record letters and words.

It was, however, not till six years later, in 1873, after many unsuccessful models had been constructed by Mr. Sholes, that the resulting crude machine, seeking a manufacturer, was brought to the notice of E. Remington & Sons, the famous gun-makers of Ilion, N. Y., in whose works at first, and afterward from 1886 in those of Wyckoff, Seamans & Benedict, under the fostering care chiefly of W. K. Jenne—the honored dean of typewriter-makers—it was mechanically improved till it became a world-famed product.

From a small and doubtfully-regarded venture, in 1873, occupying an inconsiderable corner of the old Remington gun works, it has grown to a vast selling and manufacturing enterprise, the Ilion factory of which, in the beautiful Mohawk Valley, can employ over 2,000 people and covers 6½ acres with its buildings alone.

The latter are equivalent to a building 60 feet wide, one story in height and more than a mile long, and have a capacity of a machine a minute.

The factory product embraces a variety of machine sizes and models which, with the various ingenious attachments for special purposes, such as tabulating, retail and wholesale billing, card indexing, etc., are capable of writing lines from one to twenty-five inches in length, in all the characters and styles (among the later additions are the Burmese, Armenian, Laos, and Arabic characters) of type required by many languages and the various technical branches of the same.

If it were asked how a machine composed of several hundred parts which undergo an infinite number of operations could be sold at a fair price, the answer would be "system"; for these works are dominated by system. There is also not a step in any process where inspection is not in force. Gages and templates are used throughout the plant, and every part is certain to join every other part without a hitch of any kind. The inspection is from the raw material to the boxed machine, swaddled in its flannels and hung head downward from the top of the wooden box. The typewriter is born in the pattern shop and foundry, and enters real life on the final inspector's desk.

To produce, in an economical and satisfactory manner, a machine so compact in form and simple in operation, but embodying devices adapting it to the countless varieties of work that the Remington is called upon to perform, division of labor is carried to an extreme, and "production engineering" of the most scientific character is required. The various parts are produced in the "Parts Factory," on a vast wholesale scale, and systematically stored on perpetual inventory in a well-oiled condition in the special stock-room cabinets; while typewriting machines are assembled in the machine factory from these parts in all the styles and varieties called for.

THE PARTS FACTORIES.

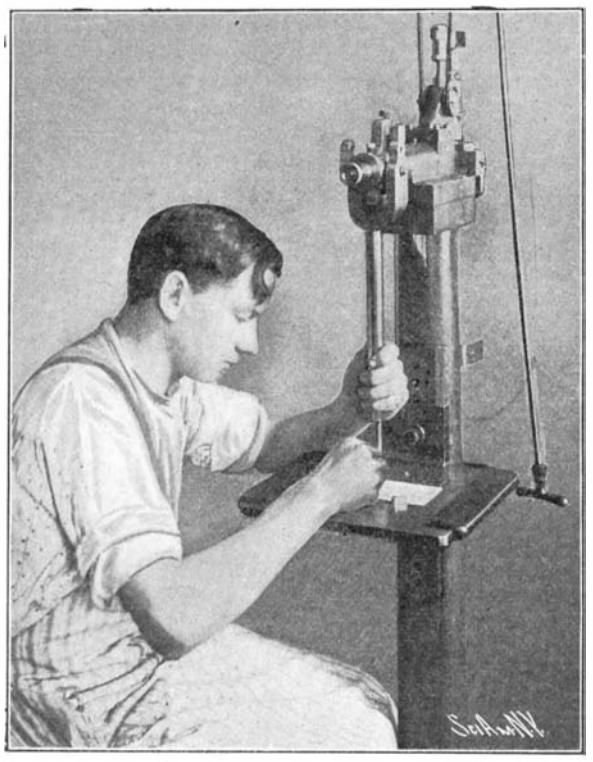
Beginning at the raw material stores in our tour of the factory, we find that countless varieties of these have to be procured with regularity and systematically stocked, besides a vast quantity of consumable factory supplies.

All the castings required are made in the company's foundries. The brass foundry with fourteen melting furnaces furnishes the various bronzes and alloys of copper, zinc, aluminium, and nickel, which are necessary for the lighter but severely-handled typewriter parts. The castings, whether of bronze or cast iron, are produced entirely by the use of twenty-three Tabor pneumatic molding machines, hand molding having been completely superseded by the cheaper, cleaner, quicker, and more accurate machine process with very finely-adjusted metal patterns. The castings of various metals after pickling, tumbling, and inspection are started on a systematic journey of the shortest possible length and with minimum handling, along with stamping, screws, and automatic machine products.

In the case of the removal of material without regard to exact gaging, belt-grinding supplies a cheap and satisfactory method of getting into and around the corners of pieces; while the drilling of one hundred holes at once in the top-plates by special automatic drilling machines in three and a half minutes, one man only being required to attend to each three machines, is perhaps the acme of labor-saving in this direction.

Each of the various distinct parts, after being drop-forged, machined accurately to gage in costly fixtures, ground, polished, annealed, plated, buffed, japanned, assembled, compounded, and finally inspected, is stored in a well-oiled condition on perpetual inventory in the cabinets of the finished parts stock room.

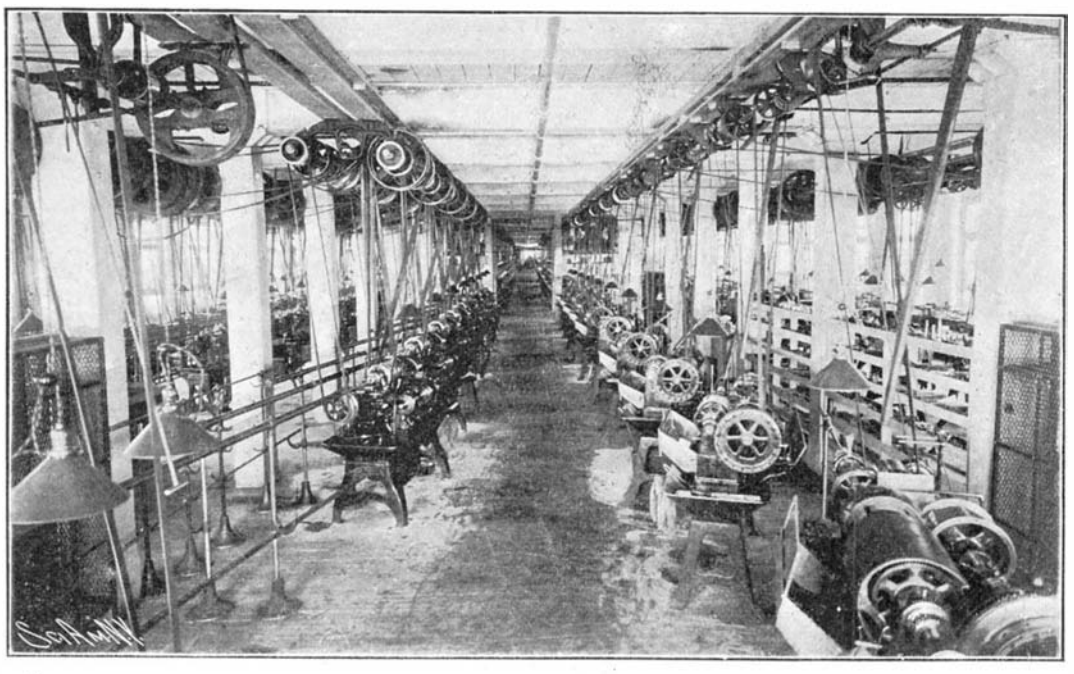
At all the stages enumerated, departmental inspection insures that every single piece with the slightest defect is promptly thrown out, and nothing but first-class work passes forward for further treatment.



Reducing Pantagraph for Making Letter Dies.

So much for the metallic components. The parts composed of glass, rubber, wood, leather, felt, etc., are similarly passed through an effective and economical routine, being shaped, gaged, and inspected after the same manner; the governing consideration being the maintaining and increasing of Remington supremacy in the matters of quality and durability of product.

Wire-cutting and spring-making are interesting special processes, while the manufacture of the type supplies some surprises for the uninitiated.



Automatic Screw Machines.

THE MANUFACTURE OF TYPEWRITERS.—THE REMINGTON MACHINE.

From an engraved plate twenty times full size, the reducing pantagraph engraving machine produces a hollow die of the true size, which when set with other dies in the type wheel and rolled under pressure over a "form" of specially-prepared soft steel blanks, furnishes a complete set of double-lettered type. These, when trimmed and hardened, are stored ready for use in machines, when called for.

THE MACHINE FACTORY.

Up to this stage in our tour we have seen nothing like a typewriter, but instead a bewildering series of unfamiliar-looking pieces passing through a routine of mechanical treatment in thousands and tens of thousands lots. In the great machine hall (60 feet by 340 feet), which we now visit, we find 3,000 typewriters of all varieties from United States Domestic and Russian to Arabic, which writes backward, in all stages of assembly. There we see the machine, after receiving a registered number, rapidly grow under our eyes in the hands of several hundred of skilled assembling experts to a frame consisting of a base, four posts, and attached top-plate with type bars in position. The rodding, first aligning, and wiring follow quickly. The "pull-cut" to synchronize the wooden key-levers is succeeded by the assembling and fitting of the ribbon movement and escapement. All this time the machine is progressing to the east along the south side of the hall, occupying after each operation open shelves specially made for it, and never once touching the floor. At this stage it meets the carriage, which has been in course of assembly from individual parts, and with the fitting of the carriage the machine can, for the first time, be made to write, and thereby show beyond a doubt to experts what rapid adjustments are needed.

A very particular "touching up" of alignment follows, and then the ordeal of final inspection and adjustment is reached, and seldom passed without criticism, as the standard is very high. The machine, at first an inert mass like any other mechanical product, receives now the very real but hardly definable qualities of "touch," responsiveness, resilience, and synchronic action, which show themselves after the "tuning-up" process is complete, and which it is the object of the shipping department to maintain intact while the machine is on a long and risky journey to New Zealand, the Philippines, India, and "the ends of the earth."

One of our engravings shows the end of the manufacturing process—a machine a minute passing out of the machine assembly hall into the packers' hands, from which it emerges to go into the packing box for shipment, every portion being firmly and delicately tied and padded against the risks of concussion and disturbance. We are indebted to the manager of the factory, Mr. John Calder, for courtesies in the preparation of the present article.

Concrete Building Blocks that Defy Detection.

So many improvements have been made in the machinery for manufacturing concrete building blocks as a substitute for building stone, and so generally have these blocks been accepted by the public, that it is only natural that the inventor should devote his attention to the material itself. Hitherto, concrete blocks, while vastly cheaper than stone and just as efficient in every way for the purposes they are used for, have been practically of a uniform color which detracted, in the eyes of some prospective purchasers, from their value as a material for making houses. In an attempt to introduce the coloring matter into these building blocks, it was found in most cases that the strength of the block itself was lost, to a great extent. Lately, however, a new material has been found which, when mixed with the concrete, will produce an almost perfect imitation of the stone that is used as a sample. Granite, with all its specks and black dots, can be imitated so that an expert will find it hard to differentiate. Indiana limestone can be made to look so nearly like the object of nature that at a few inches' distance even, the imitation cannot be detected from the original. At a recent experiment, and using an automatic Hayden machine, twenty blocks per minute were turned out with ease, and the result was so strikingly like the original stone which was used as a model, that there is no doubt whatever that the time has come when persons of moderate means will be able to build imposing houses at less than one-sixth the cost of building them of real stone.

A boat has recently been put into service on the Lake of Geneva which is driven ordinarily by a 45-horse-power Diesel engine, running at 260 revolutions per minute, but electric power is made use of at starting and for reversing. At starting the Diesel engine is disconnected from the propeller shaft, and drives only the generator and the exciter. The motor is then switched on and its torque and speed are adjusted by regulating the excitation. When full speed has been attained in this way, the motor is switched off, and the Diesel engine is directly coupled to the propeller shaft.

Correspondence.

The Changing Color of Glass.

To the Editor of the SCIENTIFIC AMERICAN:

The writer has recently observed in your columns a communication, bearing date February 1, from Mr. W. L. Brown, of San Bernardino, Cal., regarding the change in color of common white glass when exposed to the intense light of western deserts, in which he controverts the theory of an earlier contributor, that this change is due to the action on the glass of alkali in the soil of these deserts, and himself ascribes it to the oxidation of the iron present in the glass.

Mr. Brown is correct in his first statement—alkali has nothing to do with the change in question—but wrong in his own explanation. In the materials which compose common white glass, there is always present as an impurity a small quantity of oxide of iron, which in the process of manufacture is reduced to protoxide, imparting to the glass a more or less pronounced greenish tint. To guard against this, an oxidizing agent is added, and this is frequently a minute amount of peroxide of manganese, which gives up a portion of its oxygen to the protoxide of iron, converting it into the practically colorless sequioxide, while it is itself reduced to a lower and colorless oxide. Under the continued action of strong light, this colorless lower oxide of manganese is slowly oxidized to the original peroxide, and this latter imparts to the glass the amethyst or rose-purple color observed, which indeed it should do, as the amethyst itself is simply silica, colored by a minute amount of peroxide of manganese, and glass is a mixture of silicates. A. L. B.

Portland, Ore., February 22, 1905.

The Changiug Color of Glass.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of February 18 Mr. W. L. Brown reported on his observations of the discoloration of glass under the influence of sunlight. To my knowledge the phenomenon in question was originally described and interpreted by Faraday. Later it was found by Gaffield, who systematically subjected various glasses to the action of sunlight, that for many specimens a few hours' exposure was sufficient to distinctly produce a faint coloration. Of a great number of samples examined, there were only two (a certain Belgian and German glass) which withstood the action of light during a long-continued exposure.

At the present time it is known that the presence of manganese in the glass accounts for this singular deportment. The manganese may get into the glass as a contaminating ingredient of the raw material, or more especially by the process of discoloration in the glass works. Black oxide of manganese (MnO_2) is added to the fusion, for the purpose of converting the ferrous compounds into the ferric state, changing therewith the color from blue green to a faint yellow green. After the reaction is complete, the manganese occurs as proto-oxide (MnO) which forms a colorless silicate. This compound appears to be sensitive to light, either alone or more likely in presence of oxidizing agents, such as ferric compounds. The result of the chemical reaction inactuated by the energy of light will ultimately be a compound of the type Mn_2O_3, called sesquioxide of manganese. This compound is the most stable oxide of manganese, and forms a silicate of dark amethyst, violet color. R. V. HEUSER.

Erie, Pa., February 25, 1905.

Steam Navigation Prior to 1836.

To the Editor of the SCIENTIFIC AMERICAN:

In 1806 Robert McQueen, of Scotland, and a Mr. Sturtevant commenced at the corner of Barley (Reade) and Cross (Center) Streets the repairing of steam engines and boilers. In 1813 James P. Allaire, a brass founder, also commenced, under the patronage of Robert Fulton and the elder Gibbons, the repair and construction of steam engines and boilers.

The universal type of marine engine then was that of the vertical crosshead. The boiler was that known as a D and kidney flue of copper; so termed as a cross section of the furnace was that of the letter D, and the return flue at its side was shaped alike to a kidney, to conform to that of the curved vertical side of the D. Iron was not used until 1819. Prior to this the boats even hence to Albany had copper boilers.

The necessary heavy construction of the hulls of marine vessels was so fixed in the minds of shipbuilders, that they failed to recognize that river and even coast navigation did not require it, and as a result the hulls of primitive steamboats were unnecessarily heavy. The scantling of the hull of the "James Kent," in service hence to Albany, was that of a seagoing ship.

In illustration of this, the "Chancellor Livingston," which was built for service hence to Albany about 1812, was in 1826 refitted with engine and boilers and plied hence to Providence, Rhode Island.

The steam ferryboats hence to Brooklyn and Jersey City had vertical beam engines with the old parallel motion of Watt to guide the piston rod. Robert L. Stevens in 1826 introduced a single front link and slides in the ferryboat "Newark," hence to Hoboken, and the West Point Foundry in 1836 introduced links and slides in the steam ferryboat "Jamaica."

In 1821 David Dunham and Robert Fulton built a steamship, the "Robert Fulton," to ply hence to New Orleans, but the enterprise failing, she was sold to the Brazilian government and converted to a frigate. In this year the "North America," built by the Messrs. Robert L. and E. A. Stevens, made the passage from Albany here in the time, then unprecedented, of ten hours and twenty minutes.

A monopoly of the steam service on the Hudson River, which had been enjoyed solely by Robert Fulton and Robert R. Livingston, was set aside by the decision of the Chancellor of the State; and the steamboat "Olive Branch," in order to avoid the State law, would leave Jersey City early in the morning, run over to New York, leave there at the regular hour of the Albany boats, and in returning, after leaving passengers at New York, would pass over to Jersey City for the night.

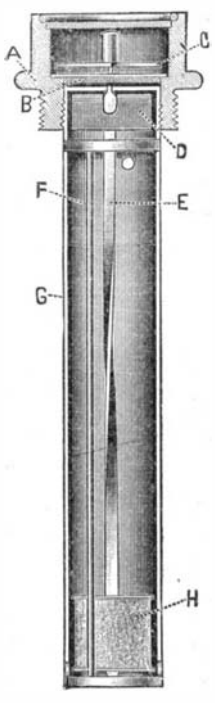
In 1821 a steamboat was advertised to make Sunday excursions. So generally was such a purpose condemned, that not only did the clergy denounce it, but a number of our citizens met and expressed displeasure, but it did not avail, and excursions were had and have continued ever since. The wail of the clergy was caricatured by the representation of a steamboat leaving her pier so crowded with clergymen and their families that some were shown hanging on to the outside of her rails. It was not until 1826 that inclosed pilot-houses were adopted and connection with the engine room effected by bells.

CHARLES H. HASWELL, C. and M.E.

New York, March 4, 1905.

A MAGNETIC INDICATOR FOR TANKS.

A very ingenious little appliance for indicating the level of a fluid in a tank was exhibited at the recent Motor Boat and Sportsmen's Show by the R. & C. Indicator Company, of Bridgeport, Conn. The construction of the indicator is well shown in the accompanying cross-sectional cut. In a closed tube, *G*, set vertically in the tank, is a float, *H*, adapted to slide on a rod, *F*, at one side of the center, and on a flat, twisted strip, *E*, placed in the center. This strip is pivoted and carries on its upper end a small bar magnet, *D*. As the float rises in the tube, it travels upward along the twisted ribbon, and, since it cannot turn about its axis the rod, *F*, it on account of the turns the ribbon, which makes one-half a revolution during the entire travel of the float. In the cap, *A*, of the tube, *G*, is a magnetized needle, *C*, which travels over a dial, *B*. This needle is moved over the dial by the bar-magnet, *D*, below it, and hence it always indicates the level of the fluid in the tank. The cap, *A*, and tube, *G*, can be removed for filling the tank, or the apparatus can be placed in another part of the tank, instead of in the regular filling hole, in which event it will not need to be disturbed. It will be found a great convenience to automobilists, launch users, and others using gasoline in quantities, as there are no holes through which the vapor can leak, and the tank is hermetically sealed as before.



A MAGNETIC INDICATOR FOR TANKS.

The Current Supplement.

The current SUPPLEMENT, No. 1523, opens with a continuation of Tsybikoff's article on Lhasa and central Tibet. Splendid illustrations accompany the text. Prof. William J. Baldwin recently delivered at the Brooklyn Polytechnic Institute's College of Arts and Engineering an excellent paper on steam-heating principles. This paper is published. The new Belgian process of electrically-welding chain, which was briefly discussed in these columns some time ago, is fully described and illustrated. Just at the present time the developments in heavy electric traction are attracting more attention than any other subject in the electrical field. For this reason readers will follow with particular interest the abstract which is published of a paper by Mr. W. B. Potter, of the General Electric Company, which paper states the opinion held by that corporation on the future of electric railway operation. "Meteorology in the British Empire," Sir John Eliot's paper, is concluded. Prof. N. Monroe Hopkins presents his eighth paper on "Experimental Electrochemistry." He discusses important conditions to be noted in electrochemical operations; caustic soda and chlorine from salt; electrolytic production of white lead; electrolytic production of cadmium yellow; electrolytic production of mercury vermilion; electrolytic production of Scheele's green; and electrolytic production of Berlin blue.

The International Commission and the Auto Races.

The recent action of the French Automobile Club regarding the Gordon Bennett Cup race awakened quite a stir in automobile circles, and finally led to the appointment of an International Commission, which recently met in Paris and succeeded in bringing this much-disputed question to a successful issue. It will be remembered that the Automobile Club of France decided to run the Gordon Bennett Cup together with the new event, the Grand Prize of $25,000 which has been recently established. The club considered that the Cup race as it was held heretofore is quite unjust to the national industry, seeing that the French cars run a chance of being beaten by another nation who may figure for but little in automobile affairs, as at present the number of cars is equal for each nation. The other clubs naturally take the opposite view of the affair, as any change in the rules tending to give a number of entries proportional to the extent of the industry would place them at a disadvantage. After the decision of the French club was announced, namely, to hold the two events at the same time and over the same course this year and afterward to modify the rules for the Cup race so as to give a proportional number of entries, all the other clubs protested energetically against such an action, and decided not to enter the races at all unless some understanding could be made. On the other hand, the French constructors who expected to enter the Cup and the Grand Prize held a meeting and decided to follow the plan of their club, or else refuse to take part in the races. This state of affairs led to the formation of the International Commission, which met at Paris on February 20. It had delegates from all the leading clubs. The delegates from France were Baron de Zuylen, M. de Dion, Réné de Kniff, Count de Vogüé; from England, Mr. J. Orde; Germany, Count Sierstorpff, Levy-Stoelping, Fasbender; Holland, M. Hombach; Austria, Prince of Solm-Braunfels; Belgium, Baron de Crawhez, Count de Liedekerke, Ph. de Burlet; Switzerland, Baron de Sulzer; Italy, Sig. Mario Monta. After considerable discussion it was finally decided that the Cup and the Grand Prize would be separated, and the Gordon Bennett Cup will be run this year according to the existing rules. The Grand Prize will be held fifteen days later. Another decision of considerable interest is that all the clubs who participate in the Cup race are to share in the expenses of the event instead of allowing a single club to bear them, as heretofore. The rules for the Cup race will be revised for the following years, so as to give a more equitable representation to the nations whose industry is the largest; and the entries, instead of being equal, will be in proportion to the importance of each nation. The proportion of entries which the Automobile Club of France decided for the Grand Prize this year will no doubt be made the base of the new rules for the Gordon Bennett Cup, and these figures will be subject to revision every year. For the Grand Prize this figure is fifteen cars for France and twenty-seven for the other countries combined. It was also decided that the eliminating trials would be run in the first part of June, the Cup race fifteen days after, and the Grand Prize in the first week of July.

Seventh Satellite of Jupiter.

Dr. Perrine, of the Lick Observatory, has discovered a seventh satellite of Jupiter. The discovery of the seventh moon was made on January 6, the day following the announcement of the discovery of the sixth satellite, when Mr. Perrine resumed his comparative examination of the negatives secured and was rewarded by discovering the image of a very faint body which changed its position from night to night.

Whether these new satellites are revolving around Jupiter in the same direction as the five inner satellites, or in an opposite direction, is not known. It is certain that the planes of their orbits make a considerable angle with each other and that they make large angles with the plane of Jupiter's equator. The distances of the two satellites from Jupiter are not very unequal, in both cases probably lying between 6,000,000 and 8,000,000 of miles.

Gas-engine power and single-phase traction are combined in an electric railway system being built to operate between Warren, Pa., and Jamestown, N. Y. The power station is being equipped with two 500-horse-power gas engines, of horizontal single-crank double-acting type, directly connected to two single-phase alternators supplying high voltage current for direct transmission—without raising transformers. A 55-horse-power gas engine is also provided for the exciter and the air compressor.

THE NEW CUNARD LINER "CARONIA."

The "Caronia," the latest addition to the Cunard fleet of transatlantic liners for service between Liverpool and this country, is the largest vessel flying the Cunard flag, excelling in length both the "Lucania" and "Campania," the present crack ships of this line, by 58 feet. The "Caronia" was constructed at the shipyard of Messrs. John Brown & Co. on the Clyde, and is incidentally the largest vessel that has ever been launched upon that river.

The principal dimensions of the vessel are as follows: Length over all, 678 feet; molded breadth, 72 feet; depth to sheltered deck, 52 feet; to boat deck, 80 feet; to top of funnels, 144 feet; loaded draft, 32 feet; tonnage, 21,150.

This vessel possesses many notable features. In the first place, although of such large dimensions, and of 18 knots speed, she is more of a passenger than a cargo vessel, although she was designed essentially as an intermediate boat. The vessel is built to the highest class of Lloyd's special survey, and at the same time has been designed so as to coincide with the conditions of the British Admiralty for service as a transport or armed cruiser.

The cellular double bottom is of especially stiff construction. There are fifteen longitudinal girders, each with a depth of 5 feet from margin plate to margin plate. The ballast tanks have a combined water-carrying capacity of 3,450 tons. For about three-fifths of the length of the vessel amidships the frames are of channel section, and angle frames are doubled forward and aft in order to brace the extremities of the hull.

There are twelve transverse bulkheads, all stiffened so as to resist any pressure that may suddenly be brought to bear upon them by flooding. The decks are all continuous, and completely plated from the bridge deck downward. The bilge keels on either side of the vessel are each 18 inches deep, and extend for a distance of half of the vessel's length amidships. The bridge deck is also carried for more than half of the vessel's length amidships, thereby conducing to the strength of the upper structure. This deck for its whole length constitutes a portion of the main structure, with all the main frames carried up to it, the side frames not being reduced in any way.

The "Caronia" is provided with eight continuous decks—the boat, promenade, bridge, shelter, upper, main, lower, and orlop. The first six of these decks are available for the convenience of passengers, and some of the third-class travelers have accommodation on the lower deck. The first-class dining saloon is a spacious and lofty apartment, extending the full width of the boat. The whole of the 300 first-class passengers can be conveniently seated simultaneously in this saloon. The decorations and appointments are tastefully carried out, the prevailing style being eighteenth century with a white color scheme. The carving is carried out in the solid wood, and is not fashioned in a composition and then adhered to a flat-surfaced foundation. The utter absence of the florid and overdone decorations that once found favor is commendable, and the effect is restful to the eye.

The other first-class apartments are also carried out with the prevailing good taste, white being the prevailing color, relieved with pale-green and rose-tinted upholstery. The smoking saloon is a particularly fine apartment and is probably the most attractive on the vessel. It is in the old English style, with walls, ceiling, and flooring all executed in oak.

The second-class accommodation is provided on the upper and shelter decks, and is practically identical with the first-class, the color scheme and decoration being the same. There is sufficient accommodation for 350 passengers of this class.

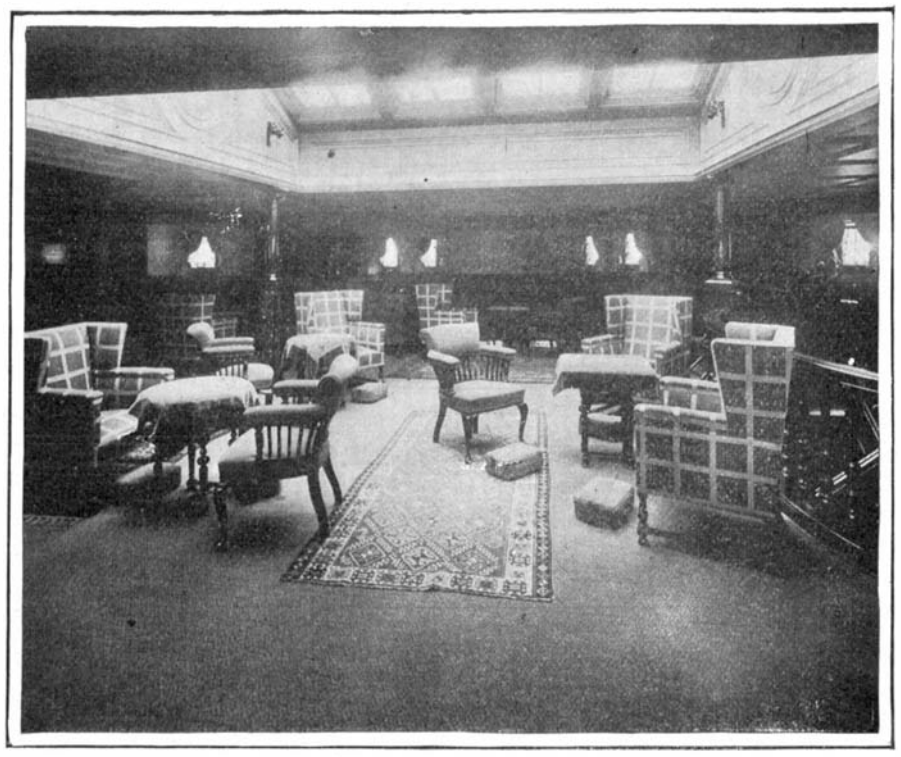
The main deck fore and aft is entirely given up to the third-class passengers, 1,000 of whom can be carried. The cabins are of two, four, and six persons' capacity, and the whole accommodation indicates a decided improvement in the convenience for this class of traveler. The crew comprises 450 officers and men, which together with 2,650 passengers of all classes gives a total maximum population of 3,100 souls.

Sixteen collapsible life-boats are carried, together with a large number of semi-collapsible boats and other equipment such as life-belts, etc. The vessel is fitted throughout with the Stone-Lloyd system of watertight doors, by means of which all passages through the transverse bulkheads may be closed simultaneously from the bridge if desired, or any individual door opened or closed from the same point as required. Another feature of this invention, which was fully described in the Scientific American Supplement some months ago, is that, even if the controlling mechanism from the bridge breaks down, the doors close automatically directly water enters a compartment.

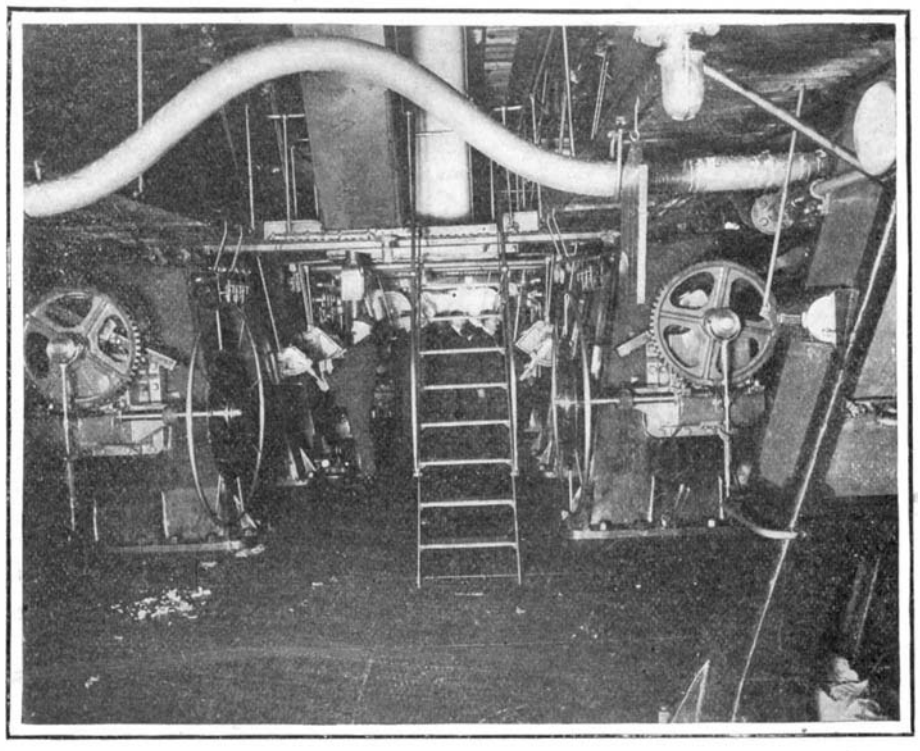
The "Caronia" is propelled by two sets of quadruple expansion engines developing together about 21,000 horse-power and giving a sea speed of about 18 knots. The cylinders are of 39 inches, 54½ inches, 77 inches, and 110 inches diameter respectively, with a stroke of 5 feet 6 inches. The last-named cylinder, it may be pointed out, is with one exception the largest that has yet been adopted for vertical engines. The machinery of this vessel has been modeled upon the lines of the Cunard steamship "Saxonia," which attracted such attention from the British Admiralty Boiler Committee during their investigations, owing to the latter's economy. The "Saxonia's" machinery required only 13.4 pounds of steam per horse-power per hour as compared with the 16 pounds per horse-power hour in the naval vessels that were tested simultaneously.

During the trial runs of the "Caronia" over the measured mile a maximum speed of 19.51 knots was

The Drawing Room.

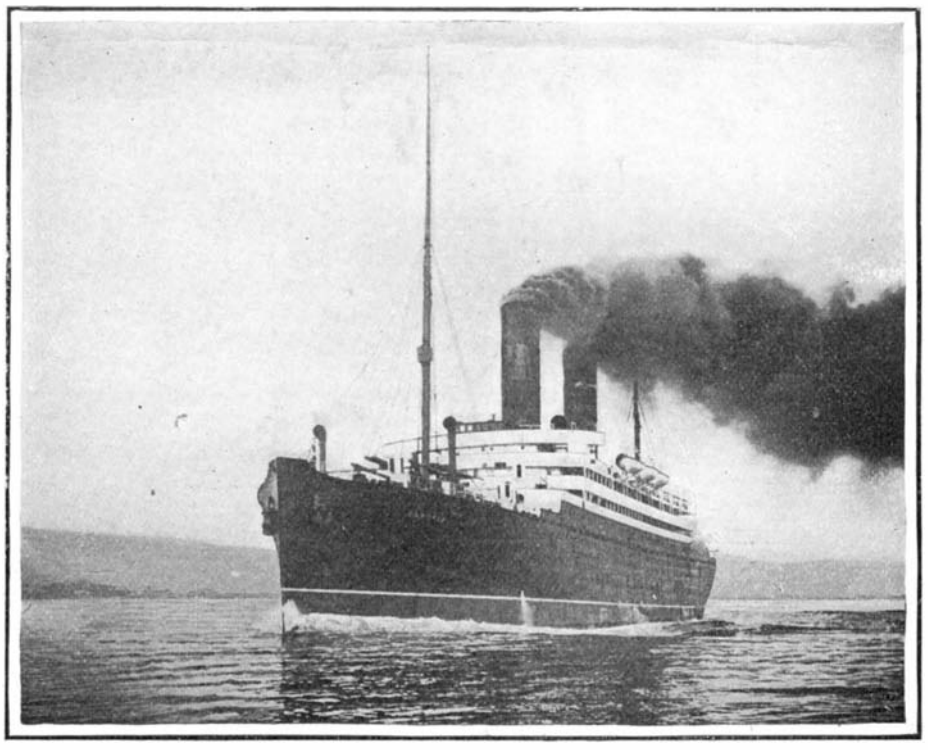


The Lounge.



Two sets of quadruple-expansion engines. Indicated horse-power, 22,700.

View on Platform of the Engine Room.



Trial Speed, 19.51 knots. **Sea Speed,** 18 knots, **Displacement,** 29,800 tons on 32 feet draft.

"Caronia" on Her Trial Trip.

THE NEW CUNARD LINER "CARONIA."

attained; and during the full-power trials, 89.2 revolutions, 21,870 horse-power, and a speed of 19.62 knots were developed and maintained for 13½ hours. The highest horse-power recorded throughout these trials was 23,500.

A sister ship to the "Caronia" is now in course of construction at the same shipyard. This vessel is of identical dimensions and tonnage, only instead of being propelled by reciprocating machinery, Parsons marine turbines are to be installed. These two vessels are to be run side by side, and comparative data in actual transatlantic practice will thus become available. This vessel, which was recently launched, is rapidly approaching completion.

The equipment of the "Caronia" is completed by an installation of Marconi's wireless telegraphy, a special room for which is provided on the boat deck.

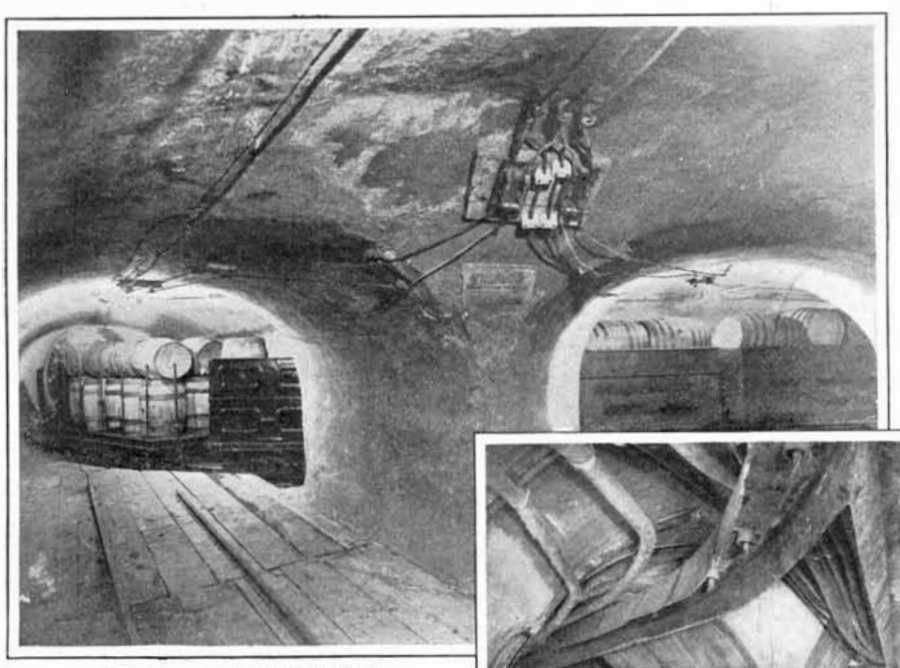
CHICAGO'S FREIGHT SUBWAYS.

In 1899 the Illinois Telegraph and Telephone Company began to build a series of tunnels under the streets of Chicago for the purpose of carrying the wires and cables of the company's automatic telephone system. ing daily many thousands of tons of freight which was formerly carried over the pavements in wagons. On February 15, 1905, the company entered into a contract with the government under which all of Chicago's second, third, and fourth class mail matter will be transferred from the railway stations to the new post office through the tunnels. A further plan to utilize the tunnels for mail purposes involves the building of chutes connecting the street-corner mail boxes with boxes in the tunnel, where the mail can be collected by cars. When the new schemes are perfected and added to the present pneumatic tube service for first-class mail, Chicago will have the most perfect underground mail facilities in the world. Eight hundred and eighty tons of mail will be handled in the tunnels daily, in special locked United States cars The system will be in operation by June 1.

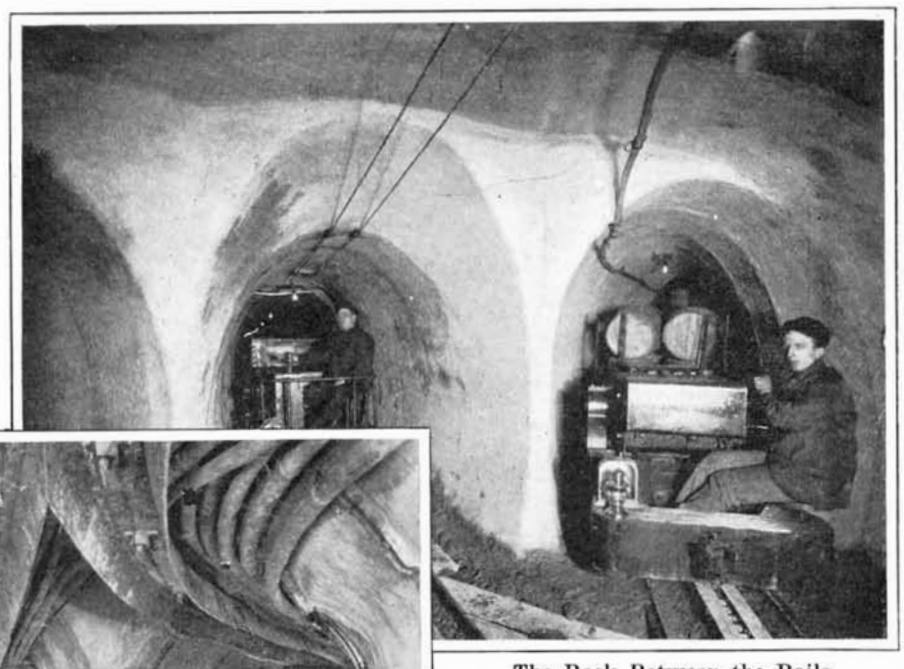
Without noise, dirt, smoke, or the slightest delay to traffic, the central business district of Chicago has been honeycombed with these tunnels. Twenty-eight miles already have been constructed, and extensions are projected.

Fourteen per cent of the railway mileage of the world sewers, and the conduits of other companies. After investigation of the soil underlying Chicago, it was decided to build a deep tunnel conduit system, as this could be done without danger to adjoining property or without interfering with other corporation rights. After considerable difficulty in securing the final municipal permit to construct the system as planned—in fact, numerous alterations were necessary—and in making an accurate survey of the streets, the company was at length allowed to begin work on the undertaking. The trunk line tunnels were to be 12 feet 9 inches by 14 feet, and the branch tunnels 6 feet by 7 feet 6 inches.

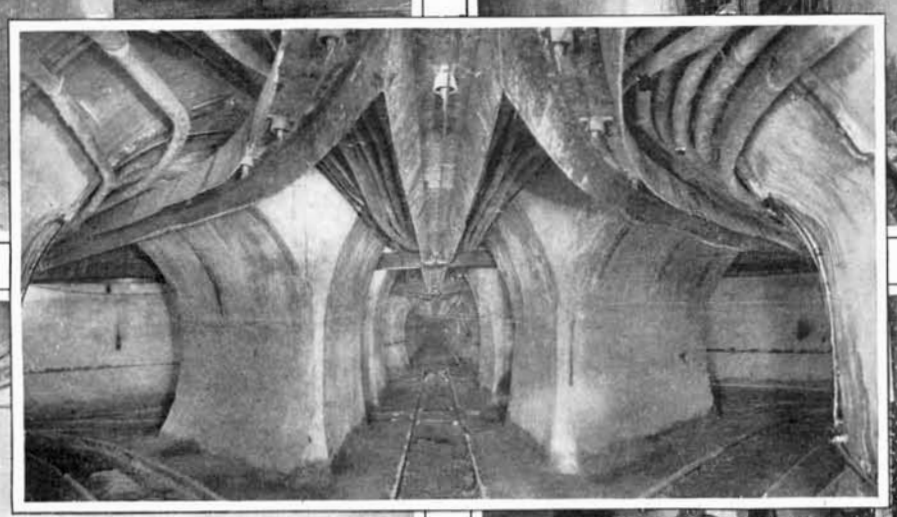
The work was carried on almost entirely in firm clay, which was encountered about 19 feet below the street grade. The pneumatic system was used more for protection against labor troubles than for other reasons, for should the workmen go out on strike, there would be no damage if the work were left for a time in an uncompleted state. The airlocks, placed just outside the seven shafts, had iron doors imbedded in concrete, and were long enough to accommodate the work, in some cases as many as ten cars being in a lock at once.



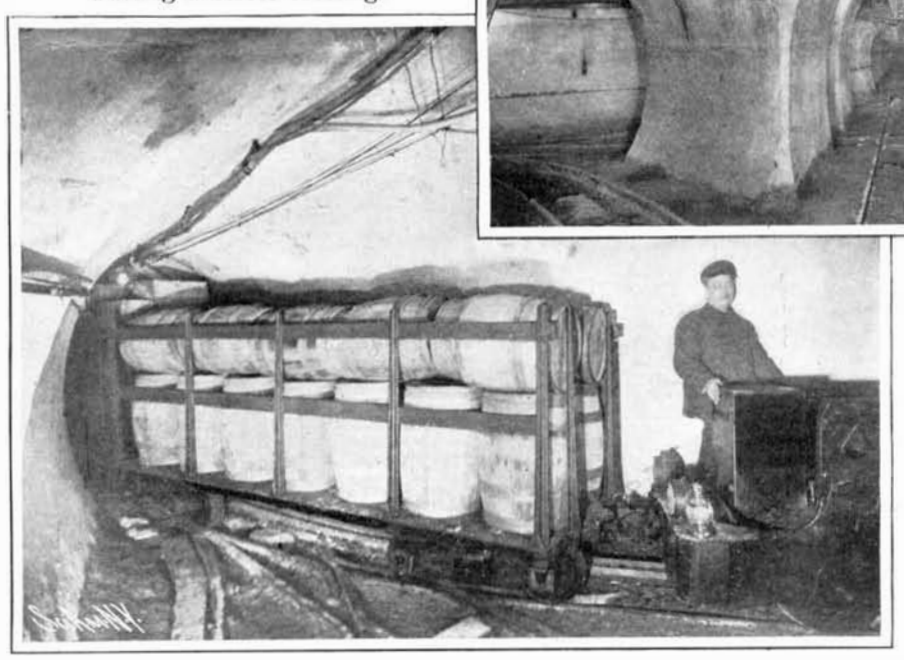
Passing a Street Crossing.



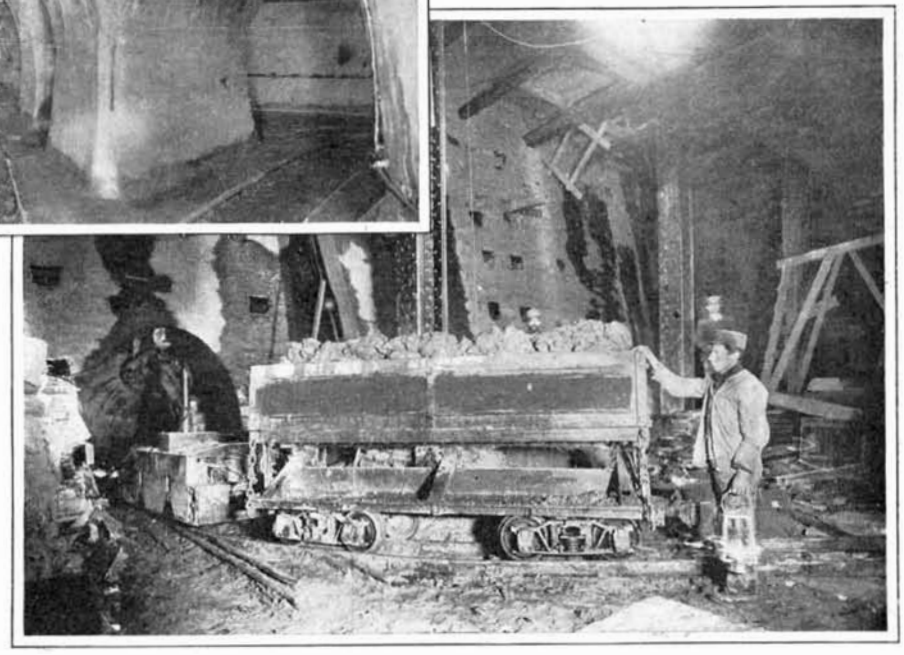
The Rack Between the Rails.



Typical Street Intersection.



Electric Locomotive and a Loaded Freight Car.



Removing Excavated Material from the Basement of a Building under Construction.

CHICAGO'S FREIGHT, EXPRESS, AND MAIL SUBWAYS.

This network of tunnels is now utilized for a quite different purpose than that for which it was originally constructed. This further use is as a system of electric traction for the handling of freight, express, and mail. The company, now incorporated under the name of the Illinois Tunnel Company, was granted a franchise for this purpose in July, 1903. It is controlled by the leading railroads which enter Chicago. Something of the immense importance of this undertaking to Chicago will be gleaned from the following account. Perhaps similar systems of tunnels will some day be built in other American cities.

The great advantage of a system of freight haulage of this kind is apparent at a glance. Far below the surface of Chicago's streets scores of electric locomotives are pulling freight trains that are taking thousands of tons of coal into the boiler rooms of skyscrapers, without dirt, noise, or sign of effort in the street. They are removing tons of ashes, and caring for the excavations from the basements of buildings in course of construction. More than this, they are haulcenters in Chicago, and operates to and from a business district one and one-half miles square. This is the territory of the freight subways. In it are thirty-eight railway stations, and every working day more than 112,000 tons of freight are moved to and from them. This situation has caused great congestion in the streets, and this the subways have met and relieved. The cars of the tunnel company are run directly into the railway freight houses, loaded, and run through the tunnels to the consignees. Here the cars are run into the basement of the warehouse through an opening cut in the masonry, raised to the desired floor on elevators, and unloaded. If the goods are not intended for immediate delivery, the cars are run into the company's storehouses and kept there till required. Every building on the route of the tunnel can be connected to it by a lateral shaft for the above purpose.

The work on the telephone tunnels was planned in 1899, but did not actually begin until September, 1901. It was found that the space below the paving was almost completely taken up by water and gas pipes,

The work was carried on by miners working in three shifts of eight hours each, the nature of the soil permitting the work to be done in this way. The distance excavated averaged about 21 feet at each of fourteen working headings, and 12 miles of tunnels were virtually completed in about ten and a half months.

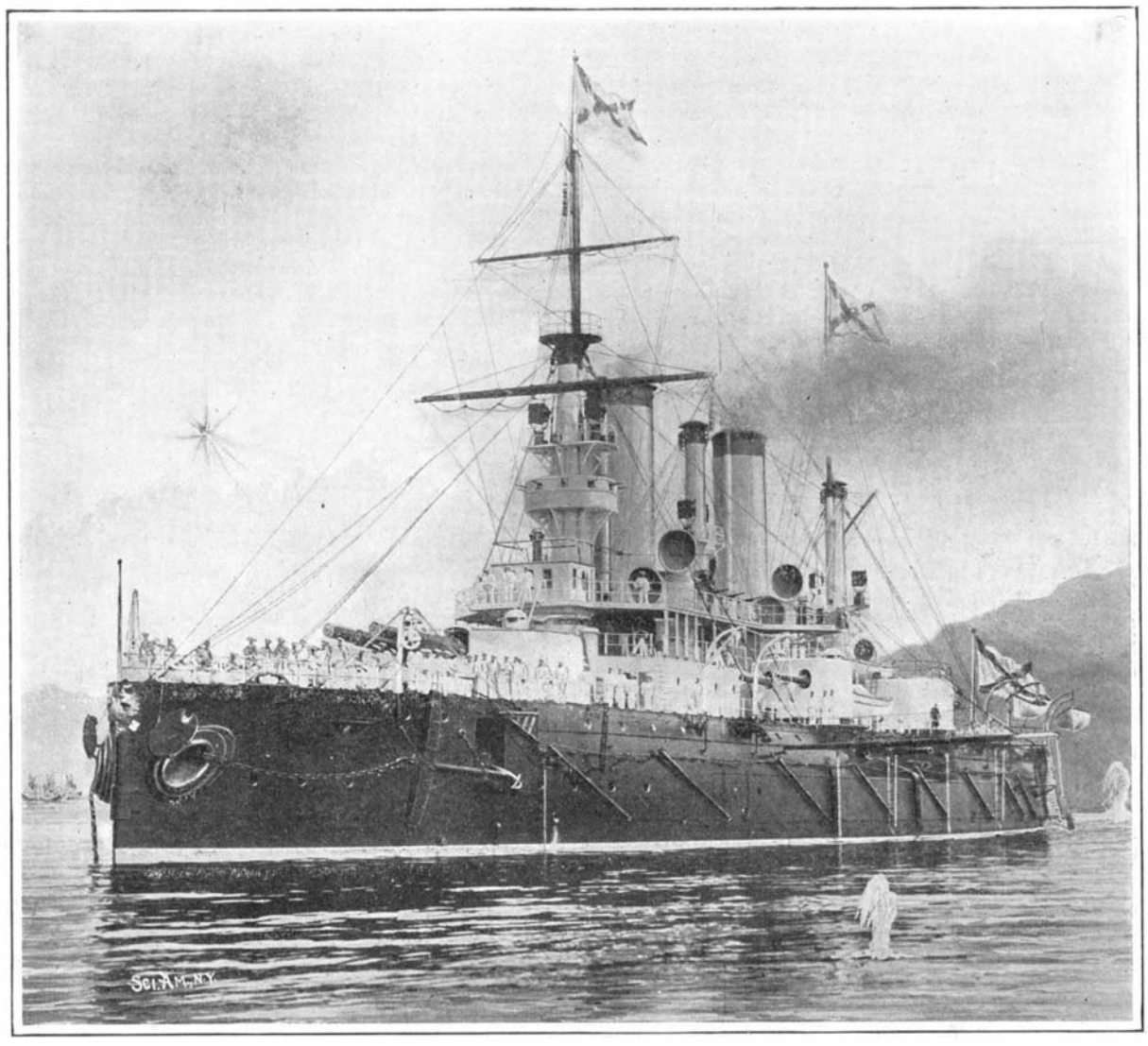
The concrete was placed in the bottom of the excavation and thoroughly tamped, the lagging placed on top of the concrete, iron ribs made of channel bars being placed on the bottom three feet apart, and the lagging laid at the sides against these ribs. The concrete was then thrown behind the two-inch plank lagging in six-inch layers. The use of concrete absolutely avoided any chance of settlement of the earth, as it was tamped into the entire space between the lagging and the excavation, no matter how irregularly the digging or mining had been done. For part of the work steel lagging plates were used as a special precaution, on account of the extra weight of the concrete. In proceeding with the work, the face of the preceding day's work was cleaned and a plaster coating of cement, made in pro-

portions of one to one, sand and cement, was plastered on the old work, forming a seal and making the structure almost entirely a homogeneous one. The 6 by 7½ lateral tunnels were constructed with 13-inch bottoms and 10-inch walls of concrete. The trunk system tunnels were built with 21-inch bottoms and 18-inch walls. The cement used for the making of the concrete was American Portland (Atlas and Chicago A. A.), and the company subjected each and every barrel to a fourteen-day test under rigid specifications. On the straight work mixtures of five parts broken stone and screenings, or five parts mixed gravel and sand, to one part of cement were used, while at the intersections a mixture of four parts stone or gravel to one of cement was adopted.

A large equipment of small tramcars, some 900 in number, built to run on a 14-inch gage, double-track system, was provided to dispose of the excavated material. The cars were hoisted by power-driven elevators up the shafts to the head-houses and the material dumped into wagons. Much of this was deposited on the lake front, a special 10-ton, stiff-leg derrick being provided for unloading the wagons. In this way much valuable land was added to Grant Park. At one shaft near the river an endless chain drew the cars up an incline onto stagings or platforms extending over dump scows moored to the dock below, and the cars were then emptied into these. The platforms could be raised and lowered as required, so as not to interfere with the river traffic.

The steepest grade in the tunnels is 1.75 per cent, and the grades at the railway terminals do not exceed 12 per cent. The latter steep grades form the approaches to the tunnels, which are built with the rails some 30 feet below the street level. The four-way intersections have curves of 20-foot radius, and the sharpest curves on the main lines are of 16-foot radius.

The track is 2-foot gage, laid with 56-pound T-rails fastened by bolted clamps to cast-iron chairs imbedded in the concrete floor of the tunnel. Part of the system is overhead trolley, while the rest is of the Morgan third-rail traction system. This latter consists of a perforated metal plate (½ inch thick and 4 inches wide) forming a rack which is bolted between two lines of timber stringers. These serve to protect and support the rail. A special construction for the tunnel work was devised in the use of chairs of bent steel channels to support the rack. The locomotives are of the class used in mine haulage work, but are peculiar in the method of taking current. The rack rail serves both for traction and as a third-rail conductor, the current being led to motors, geared to the axles, with suitable controlling devices. The track rails are used for the return current. The wheel base of the locomotives is 24½ inches. With one 75-horse-power motor the weight is about 3 tons; with two 80-horse-power motors, about 5 tons. The trolley locomotives are of the ordinary type used in mine systems.



This ship was twice struck by mines, and once by a torpedo, without being sunk. She was the last of the Port Arthur fleet to be destroyed. When 203-Meter Hill was captured she went outside the harbor, where the lofty Liaoshan Mountain screened her from observation. She let down her torpedo nets and was three times attacked by the whole torpedo squadron before she was hit. She did not sink; but next day, Capt. Von Essen opened her valves and sank her in deep water.

The Battleship "Sevastopol" in Port Arthur Harbor.

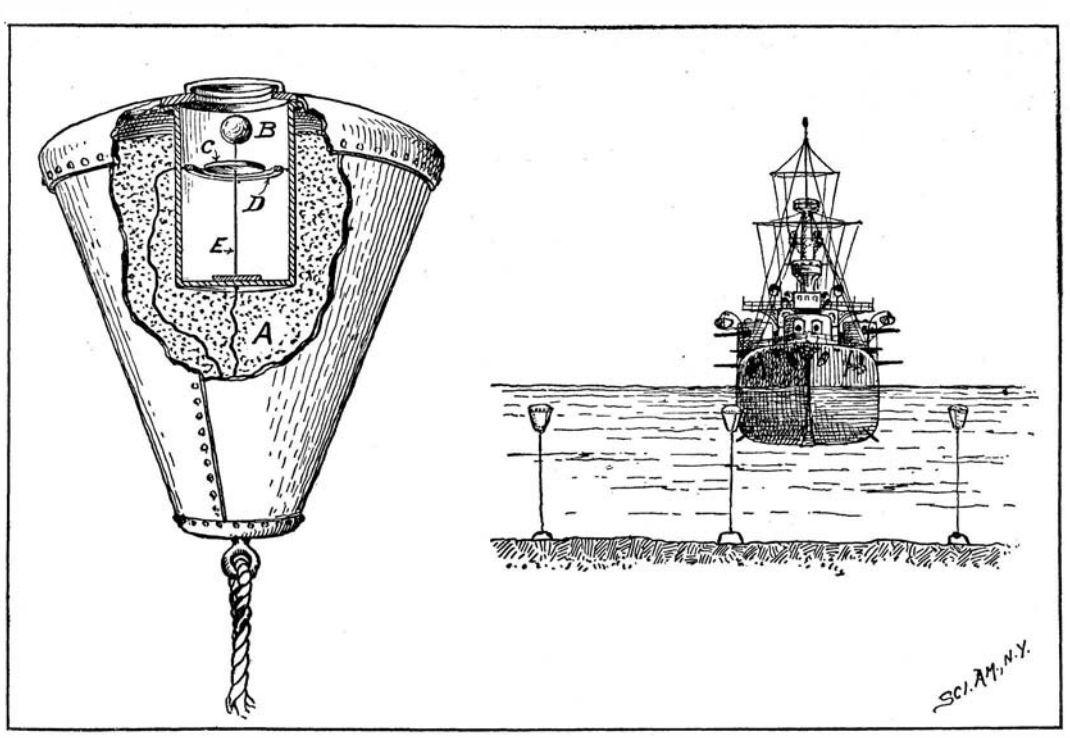
Eighty-five and six-tenths per cent of the freight cars of the United States now have air brakes.

STORY OF THE OPERATIONS OF THE RUSSIAN FLEET AT PT. ARTHUR AS TOLD BY ONE OF THE COMMANDERS.

To all interested observers of the great naval conflict between Russia and Japan, it has been a matter of regret that so little has been made known as to the actual work done, during the long siege of Port Arthur, by the ships of the Russian navy. The information contained in official dispatches has been sufficient to give the general public only a vague idea of what was taking place behind the impenetrable curtain, which a strict censorship flung before the stage whereon this, the greatest and most heroic naval drama of modern times, was being enacted.

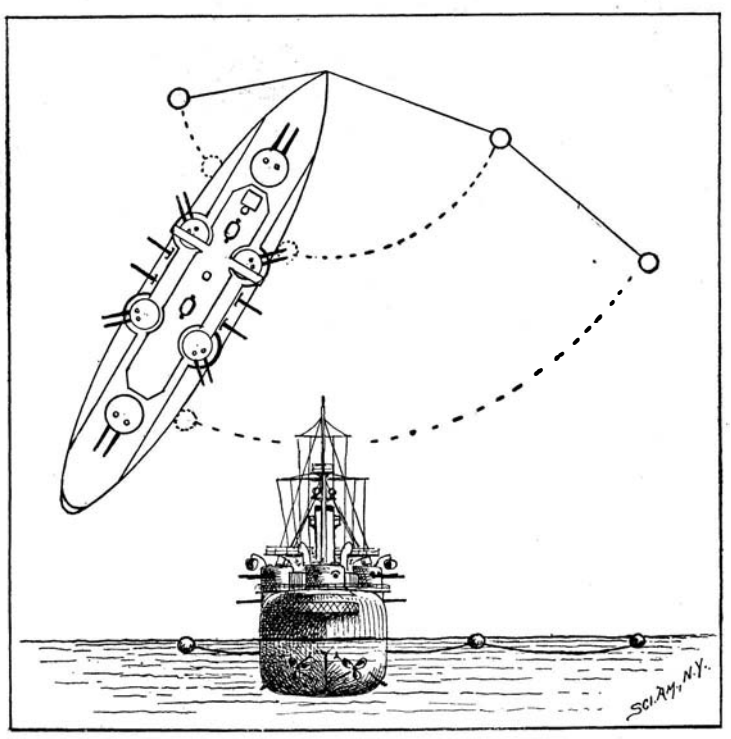
The sudden loss of three of the best ships of the Russian fleet, in the unlooked-for torpedo attack on the night of February 8, placed the Russians at such a numerical disadvantage, that there was little hope of achieving any decisive victory over the Japanese until reinforcements should arrive from Europe. All the subsequent engagements were fought against odds which rendered the result, barring accident, a foregone conclusion. To be convinced of this, it is only necessary to bear in mind that the torpedo attack of February 8 and the battle outside Port Arthur on the morning of February 9, resulted in the torpedoing of the two best battleships and one of the finest cruisers of the fleet, and the disablement of one of the battleships and three of the cruisers by shot holes below the waterline. From that time to the final sinking of the "Sevastopol" in the last days of December, practically all our information regarding the Russian fleet has come from Japanese official reports; and while these have been in the main reliable, they have consisted chiefly of statements of the damage inflicted by the Japanese either by gun, torpedo, or mine, and have given us very little information as to the damage and loss which they themselves have received from the Russians.

During the long months of the siege, it was a matter of frequent speculation as to what was being done by the Port Arthur fleet in repairing the serious injuries



This is the type of stationary, or anchored, mine used by the Japanese, whose torpedo boats ran in to the mouth of the harbor at night, and dropped them in position across the channel. They consisted of an iron shell filled with high explosive, *A*. The firing mechanism consisted of a ball, *B*; flexible rod, *E*; contact disk, *C*; and contact ring, *D*. When mine was struck by ship, *C* was thrown against *D*; circuit was closed and *A* was detonated.

Anchored Mines, Laid by the Japanese, and Removed by "Sweeping."



The Japanese strewed in the outer channel, leading to Port Arthur, a number of floating mines, connected by cables, in sets of two or three. The "Petropavlovsk" struck one of these, and as she moved forward the mines swung in, wrecking her hull at three separate points.

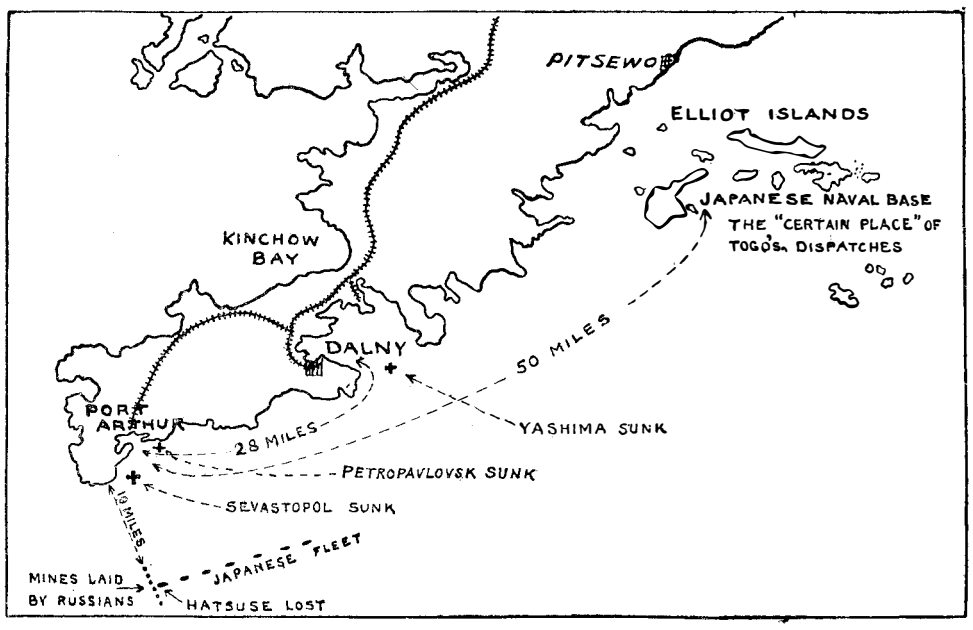
How Makaroff's Flagship, "Petropavlovsk," Was Sunk.

THE OPERATIONS OF THE RUSSIAN FLEET AT FORT ARTHUR.

received in the first attack, and there was much curiosity as to how it was possible for these torpedoed ships to be put in such serviceable condition that they could make frequent sorties, and finally engage in one of the fiercest and most stubborn naval battles of history. It was known that Port Arthur possessed but one drydock; and yet here were four battleships and a large cruiser, that in the space of a few months recovered from torpedo injuries which, theoretically, should have put them out of action for the rest of the war. Moreover, they were able to engage in evolutions, keep proper station, and inflict serious damage upon the enemy in a long-drawn-out and fiercely-contested battle.

The answer to these questions is given in the present article, in which the SCIENTIFIC AMERICAN is enabled to present to the world, for the first time, the story of the brave struggle made by the crippled Russian fleet, in its uphill fight against the combined forces of Admiral Togo afloat and Gen. Nogi ashore.

For our facts we are indebted to the courtesy of Capt. N. O. von Essen, who was in command of the battleship "Sevastopol," and to Commander N. A. Saxe, who kindly furnished the information from which the accompanying diagrams were drawn. These gentlemen are now on their way to St. Petersburg from Port Arthur, and the editor is indebted to them for a lengthy interview, in which, concurrently with the narration of the heroic work done by all grades of the service in the Russian fleet, they paid a high tribute to the skill, courage, and courtesy of the Japanese officers and men.

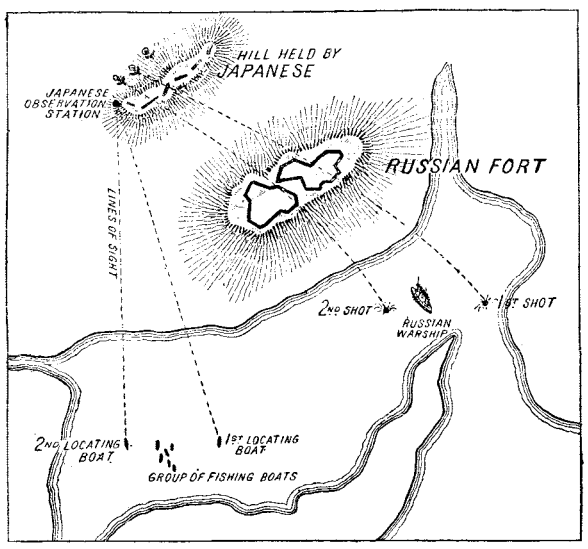


The naval base (the "certain place" so often mentioned by Admiral Togo) was a sheltered bay in the Elliot Islands. Here the ships were coaled, watered, and their stores of ammunition, etc., replenished. Dalny was the base for the besieging army of General Nogi.

Map Showing Port Arthur and the Japanese Naval Base, Fifty Miles Distant.

Immediately after the disaster of the night of February 8, the cruiser "Pallada" was floated into drydock, and the battleships "Czarevitch" and "Retvizan" were taken into the inner harbor, and repairs executed by means of caissons of timber built around the gaping holes which had been blown into their hulls by torpedoes. The repairs to the "Pallada" were completed early in April, and about the 20th of June the "Czarevitch" and "Retvizan" were also in condition to take the sea. On the 13th of April, during the sortie in which the "Petropavlovsk" was sunk with Admiral Makaroff on board, the battleship "Pobieda," in returning to the harbor, struck a contact mine, and was heavily damaged. Similar repairs were executed, and this ship was able to take her station in the line in the great sortie of August 10.

On June 23, Capt. von Essen's ship, the "Sevastopol," was sent outside the harbor to drive off several Japanese cruisers that were shelling the line of fortifications to the east of Port Arthur. This she accomplished; but, in returning, she struck a Japanese mine, which blew in about 400 square feet on the starboard side, abaft the foremast, at a depth of about 7 feet below the waterline. The rent was from 7 to 10 feet in depth and 35 feet to 40 feet in length. The frames, ten in all, were bent inward, or torn entirely apart, and the plating blown bodily into the ship. She was taken into the inner harbor, and a repair caisson was used to inclose the injured portion of the hull, in the manner shown in the accompanying engraving. The caisson was built of 9 x 9 timbers, tongued and grooved and dovetailed. The floor, which was from 17 to 22 feet in width, rested against the bilge keel, and the outer wall, which was at a distance of about 10 feet from the hull, had a total depth of from 32 to 35 feet, the length of the caisson being about 75 feet. Knee bracing of heavy timbers was worked in between the floor and the wall, and the construction was further stiffened by heavy diagonal bolts, which passed through from floor to outside wall, as shown in our sketch. The joint where the edge of the caisson abutted on the hull of the ship was formed of hemp packing covered with canvas. The whole of the outside of the caisson was covered with canvas, and outside of this a heavy coating of hot tar was laid on. The caisson was then floated into position, and drawn up snugly against the side of the ship by means of cables, some of which passed entirely underneath the ship and were drawn tight on the port side, while others were attached to the top edge of the caisson and were led across to the steam winches on deck. After the caisson had been drawn to a snug fit, the water was pumped out, and the hydraulic pressure served to hold the caisson tightly against the hull. The damaged plating was then removed by cutting off the rivet heads, and the broken portions of the framing were cut away. While this work was proceeding, new frames and plates were being prepared in the dockyard shops. The frames were built into the ship, the plating riveted on, and the vessel finally restored to first-class condition. The whole of the work was accomplished in six weeks' time; which, considering that the shops in which the new framing was prepared and the ship herself were under fire, must be regarded as a most remarkable and highly creditable performance.

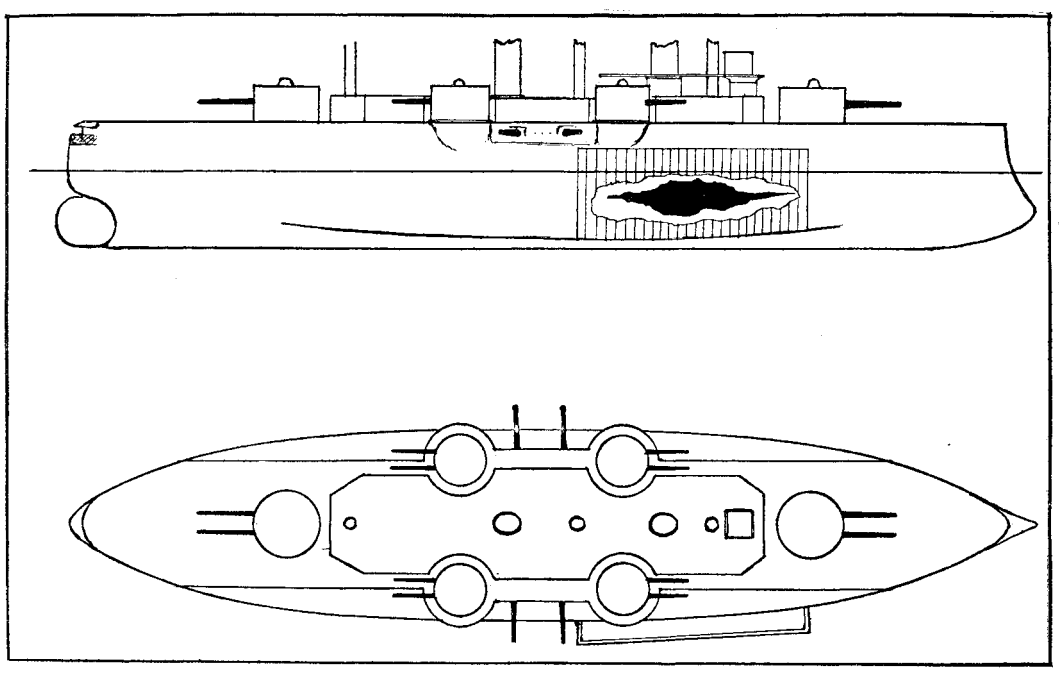


Before the capture of 203-Meter Hill, the Japanese could not see the Russian fleet, which lay behind lofty hills. Chinese spies went fishing at a spot where they could see the fall of Japanese shells and signal the result to a distant Japanese observation station. If a shot fell to the right of the ship, one boat would move to the right; if to the left, another boat would move to the left.

Why the Russians Forbade all Fishing at Port Arthur.

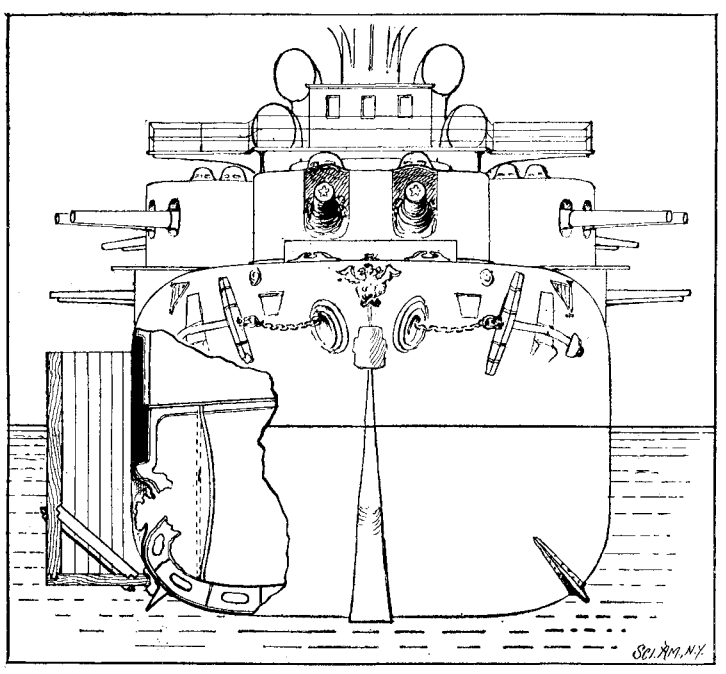
On September 20, during operations outside the harbor, the "Sevastopol" again struck a mine, and by a curious coincidence she was damaged in the exact spot where she received the first injury. This time, however, the mine was very much larger, and is estimated to have contained fully 400 pounds of high explosive. The shock was terrific, and the area of injury covered fully 700 square feet. A repair caisson was applied to the ship, which had been kept on an even keel by opening the valves on the port side, and admitting sufficient water to balance the inflow on the starboard side. The repairing of this damage was, of course, a longer job. Moreover, it was done at a time when the 11-inch mortar batteries, which ultimately sank the fleet, were getting the range and making frequent hits. One 11-inch shell struck the bridge just above the caisson, and, bursting, a shower of heavy fragments tore through the outer wall of the caisson, letting in the water and necessitating extensive repairs. Nevertheless, the "Sevastopol" was again put in seaworthy condition in about two and a half months' time.

As showing the heroic efforts, made under these most distressing circumstances, to turn defeat into victory, it may be mentioned that during the eleven months of the siege, five big repair jobs of the magnitude above described were completed, and over one dozen perforations in the hull below the belt, due to heavy projectiles, were repaired, either in drydock or by the caisson method. This work was done under a constant rain of projectiles, and in the case of the drydock repairs, the shells that missed the ships would burst on impact against the stone walls of the dock, and the fragments scatter among the workmen. Evidently, the Russians have lost none of their proverbial fortitude.



Outboard profile and deck-plan of the "Sevastopol," showing the cofferdam, and (in black) the area of hull affected by the mine explosion.

How Repairs Were Made Without Entering Drydock.



Sectional view showing the water-tight caisson 10 feet wide, 35 feet deep, 75 feet long, by which the injured side of the "Sevastopol" and other battleships was laid clear of water, while the wrecked structure was removed, and new frames and plating were built in place.

Five Vessels Wrecked by Mines Were Repaired by the Caisson Method.

THE OPERATIONS OF THE RUSSIAN FLEET AT PORT ARTHUR.

Before the capture of 203-Meter Hill, the hits that were made upon the ships were due to indirect or high-angle fire, in which the gunners could not see the ships. The aiming was largely guesswork, for the Japanese did not command any height from which they could see the vessels. Nevertheless, the fire for a while was so intelligently directed as to make it evident to the Russians that some system of signaling existed. It was ultimately found that some Chinese fishermen were in the habit of frequenting a certain spot in the harbor, from which they could watch the Russian ships, and be themselves clearly discerned by field glasses from a distant hill that was occupied by the Japanese. Careful observation of these simple-minded Celestials, as they were engaged in their laudable effort to pick up some greatly-needed food from the sea, revealed the fact that when a shot fell beyond a particular ship, one of these boats immediately moved out beyond the group in a corresponding direction, say to the right; that if the next shot fell to the left, John Chinaman would immediately conclude that he could find better fishing if he moved somewhat over to the left of the fleet of boats. These movements were duly noted from the Japanese observation station, and the fire directed accordingly. Needless to say, there was no more fishing permitted in that particular section of the harbor. Not long afterward, however, the fire began again to grow remarkably accurate, and it was noticed that a certain Chinaman (so called) occasionally waded into the shallows with a couple of buckets, apparently in search of crabs, and that one bucket was white and the other black. If the Japanese shot fell beyond the mark, the black bucket would be carried off a corresponding distance beyond the white bucket; or if the shot fell short, or to the left or right, strange to relate, the black bucket would move in sympathy; and if a hit were made, the industrious crab catcher would place his buckets together. Commander Saxe, who related this particular circumstance to the writer, said that he was satisfied now that they had treated the native population altogether too leniently; for in spite of undoubted evidence that signaling was carried on extensively both by day and by night, not a single native was executed as a spy during the course of the siege.

The severest loss of the whole campaign was the tragic death of Admiral Makaroff when the "Petropavlovsk" was blown up by striking three floating mines. These mines, as shown in our sketch, were connected by cables, and floated at the surface of the water. They had been dropped by the Japanese on the night preceding the sortie, and directly across the course usually taken by the Russian fleet. When the bow of the "Petropavlovsk" struck the connecting cable, she carried it along with her and, of course, swung in the mines against her side, one probably to port and two to starboard. The terrific shock in all probability detonated the high explosives on board; for the ship disappeared bodily from sight within two minutes after the explosions. Most of the damage by mines was wrought by anchored mines of the type shown in accompanying engraving. The cone-shaped steel shell, containing from 200 to 400 pounds of high explosive, is anchored to a heavy weight resting on the bottom, by means of a cable of such a length as to maintain the mines at a depth of from 8 to 10 feet below the surface. Within the shell is a cylinder which contains the firing mechanism. This consists of a steel ball, carried at the top of a flexible vertical steel rod, which passes through and supports a metal disk. Arranged concentrically around the disk, but not touching it, is a metal ring. When a ship strikes the mine, the inertia of the weight or ball carries the disk against the ring, closes an electrical circuit, and detonates the charge of gun-cotton.

The damage wrought by mine, torpedo, and gun was not by any means confined to the Russian fleet. Commander Saxe confirms the story of the sinking of the battleship "Yashima" by a mine at Dalny, and the loss of the "Hatsuse," also by a mine, near Port Arthur. These ships are lost beyond recovery. Several Japanese cruisers have been sunk by mines, by the torpedo, or by collisions, to say nothing of a considerable number of torpedo boats and torpedo destroyers that were sunk by gunfire. The story of the loss of the "Hatsuse," as told by Commander Saxe, is particularly interesting. It had been observed that the blockading fleet was in the habit of steaming slowly to and fro, in line ahead, on a course generally parallel with the coast line and at a distance of ten miles from the harbor. Accordingly, the torpedo transport "Amur" was sent out at night ten miles from shore, with orders to commence dropping torpedoes from her stern at intervals of from 50 to 100 feet, on a line one mile in length and at right angles to the course ordinarily followed by the Japanese fleet. This was done, and the next day the battleship "Hatsuse," in passing over the line, struck one or more torpedoes, with the result that her magazines were exploded. The vast cloud of smoke was distinctly visible from the Russian forts; and she sank in not over one minute after the explosion took place. This left the Japanese fleet with but four battleships as against six that were able to steam out of Port Arthur in the famous sortie of August 10.

Limitations of space prevent us going at full detail into the description of this famous sea fight—the greatest in modern times. The Japanese battleships, warned by their torpedo boats of the sortie, came up rapidly and opened fire with their big guns at a range of from seven to nine miles; and owing to the fact that they carried telescopic sights, and the Russian ships did not, the Japanese made fairly good shooting, even at this great distance. As the ships drew to closer range the Russian gunners found the enemy, and placed their shells with telling effect, great destruction being wrought on both fleets. On the Japanese side the flagship "Mikasa" suffered the most heavily, and was at times completely enveloped in the smoke of the bursting Russian shells. Matters were going fairly evenly between the two fleets, until a 12-inch shell entered through the sighting slot between the wall and roof of the conning tower of the flagship "Czarevitch," which was at the head of the line; burst inside; killed the admiral; and jammed the steering gear over to port, causing the "Czarevitch" to commence steaming in a circle. The "Retvizan," next in line to the "Czarevitch," began to follow her to port; but discovering the plight of the "Czarevitch," and in the endeavor to protect her, she swung sharply to starboard and steamed directly for the Japanese line, followed by the "Pobieda." The Japanese, true to their policy of avoiding close ranges, turned also to starboard and drew away. Capt. von Essen noticed that, as the range decreased, the Japanese shells flew high; and it was at this time that the bridges, masts, and smokestacks were riddled. The mishap to the "Czarevitch" and the change of course of the "Retvizan" threw the Russian line into disorder, and ultimately the admiral who had taken over the command, signaled the fleet to return to Port Arthur. Capt. von Essen is of the opinion that the Japanese must have suffered very severely; for they drew off at a time when, had they been in good fighting condition, an opportunity was afforded for dealing a crushing blow to the scattered Russian fleet. Toward the close of the action the "Mikasa" had only one 12-inch gun in action, and orders were finally signaled by Admiral Togo to his fleet to draw off toward Dalny, taking particular caution against torpedo-boat attack. As night closed in, it was seen that the "Mikasa" was gradually falling astern. Subsequently to the capitulation of Port Arthur, it was learned from the Japanese that three of their torpedo boats, which were searching in the darkness for the crippled "Czarevitch," encountered the "Mikasa" and attacked her, thinking she was the quarry they were after. One torpedo struck her before the mistake was discovered. Confirmation of this disaster was seen in the fact that, after the first attack on 203-Meter Hill, sailors' caps bearing the name "Mikasa" were found among the Japanese killed. It is believed, however, that she has been repaired, and probably she is in service at the present time.

In that fight the "Sevastopol" lost over 100 men killed and wounded. Subsequently, all hope of effecting a movement to the port of Vladivostock was deemed hopeless, at least until the arrival of the Baltic fleet. The lighter guns were accordingly sent ashore to the fortifications, and the intervening time between the sortie and the surrender of the fortress was occupied in repairs, in work at the forts, and occasional demonstrations outside the harbor. Ultimately, word was sent to the fleet from Gen. Stoessel that the Japanese had captured 203-Meter Hill, and that the ships would be subjected to direct observation. The "Sevastopol" was the last ship to be destroyed. To escape observation from the captured hill, she steamed outside the harbor and took up a position under Liaoshan Mountain. Her torpedo nets were let down, and, although only 100 men were left on board, and the rapid-fire guns had been sent ashore for use in the forts, Capt. von Essen prepared for the inevitable night torpedo attack. Three of these were made before a torpedo got home. The torpedo boats steamed past under a fierce fire from the ship and the forts at a distance of about 1,200 yards. discharging a great number of torpedoes, which exploded on contact with the net, and at the same time using their machine guns, 12-pounders and 6-pounders. Four of the torpedo boats were crippled or sunk. Finally, in a blinding snowstorm and a very rough sea, a small torpedo boat managed to rush in within a few hundred yards and discharge a torpedo that struck the "Sevastopol" near the stern. The torpedo flotilla now considered that their work was done, and withdrew; but the next day Capt. von Essen, steering with his two engines, carried the ship out into 90 fathoms of water and opened the sea valves. As he was rowed away, he saw the ship turn bottom up and sink in waters from which she can never be recovered.

In conclusion, we asked both of these officers what was their opinion, after eleven months of the very fiercest and most destructive kind of fighting, as to the relative value of battleships and cruisers. They both affirmed their belief that the battleship had demonstrated itself to be the supreme engine of modern naval warfare; and that the nation which can put the largest number of battleships into the fighting line, and that can handle them, when there, with skill, courage, and fortitude, must ever maintain the command of the seas.

Science Notes.

Two French aeronauts, Faure and Lathom, have made a balloon voyage from the Crystal Palace, South London, to St. Denis, a suburb of Paris, a distance of 250 miles, in 6½ hours.

The Ibis contains a short but interesting account of the discovery of the hitherto unknown eggs of the knot (*Tringa canutus*). A nest of this species, containing four eggs, was found on June 17, 1898, in the island of Hrisey, to the north of Iceland. The bird was breeding with several pairs of *Tringa maritima*—the purple sandpiper—and was kept under close observation for some time before the eggs were taken. It was not killed, as the collector hoped to have the good fortune to obtain a second clutch. The eggs are described as "quite like very large eggs of the dunlin (*Tringa alpina*), of the closely-spotted type, and cannot be confounded with any others of the same size."

In dry weather the fibers used in the textile industries are liable to become electrified during combing and other similar operations, with the result that their treatment becomes very difficult. It is now well known that the discharge of a-rays from a radio-active substance "ionizes" the air in its neighborhood (that is, renders this air a conductor of electricity), so that an electrified body placed near a radio-active substance is quickly discharged. Technics suggests that this property might perhaps be utilized in the textile industries to prevent the electrification of the fibers. The cost of radium is so great that this substance could scarcely be used; but thorium (which is much cheaper) has similar properties, although its ionizing capacity is smaller; even disused gas mantles will quickly discharge an electroscope in their neighborhood.

John B. Eyster, of York, Pa., senior at Wesleyan and captain of this year's football team, was the subject of an interesting experiment in the calorimeter in charge of Prof. Benedict of the science department. The regular mid-year examination began February 13. Eyster had an examination in advanced French, and instead of taking it with the rest of the class, Prof. Kuhns of the French department consented to let him take it alone in the calorimeter. The purpose of the experiment was to determine the amount of mental energy expended in the course of a college examination. This was Eyster's first experience as a subject of scientific investigation, and that no element of nervousness might interfere with the grade of his examination or with the operation of the experiment, he had an hour to accustom himself to the "box." He was to enter about 8 o'clock and the experiment will last from 9 until 12. The results have not been published as yet.

X-rays have proved valuable in the examination of patients suffering from diseases of the chest. "It is scarcely going too far" (to quote from Dr. Holland) "to say that the only certain means of diagnosing thoracic aneurism is a careful X-ray examination, and that the skilled radiographer can nearly always answer 'yes' or 'no' if the question for or against is put to him. Next to aneurism, the great value of X-rays is seen in cases of pulmonary consumption. In the first place, a careful examination of an affected chest at intervals, during the course of an illness, may not only be of great interest, but also of great use, as an additional means of indicating the course of the disease; and in the second place, in the very early cases—the merely suspicious cases, indeed—an X-ray examination is essential. It has been proved beyond all doubt that marked radiographic changes from normal, suggestive of tubercular disease, have now been found when only the merest suspicion of phthisis has existed; when no so-called physical signs have been detected; when no tubercle bacilli have been found in the sputum, if there was any of the latter to be obtained; when the only symptoms giving rise to anxiety have been some ill-health, loss of weight, and perhaps cough and dyspeptic troubles. It is a serious matter to urge, say, a business man, with much depending upon him, to throw up everything and go through several months of open-air treatment on a vague suspicion alone; it is still more serious to put off doing this until unequivocal signs have developed, and it may be too late. Radiography, in these cases, is now invaluable; and it is not going too far to assert that in such a case, given a radiographic examination by one competent to form an opinion—a most important matter—if suggestive radiographic changes are found, the patient can be unhesitatingly advised of his danger and the necessity of immediate action; given no radiographic changes, it is quite justifiable to wait and watch.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

LOCKING-INSULATOR.—L. STEINBERGER, New York, N. Y. Mr. Steinberger's invention relates more particularly to an insulator for carrying wires for electric light and power and for telegraph and telephone services and in all other relations where wires are required to be insulated from their supports. It saves time and money now wasted on tie-wires. By its use an unskilled workman is able to fasten and lock the wire to the insulator. It also tends to save battery-power now wasted incidental to leakage from tie-wires and is ready for mounting without the use of pins and boring-tools.

INSULATOR-SUPPORT. — L. STEINBERGER, New York, N. Y. This improvement has reference to insulator-supports and admits of general use, but is more particularly adapted for use with a type of insulator employed for supporting outdoor wires which are exposed to the action of the weather. When the device is mounted any rain, sleet, or snow which may fall within the recess made to guide falling elements, is guided off and escapes downwardly at a comparatively low point. The cross-beam is thus protected from the action of water, sleet, etc.

HYGIENIC TELEPHONE-RECEIVER. — L. STEINBERGER, New York, N. Y. The inventor's aim is to provide a receiver with a removable hygienic member for protecting the ear from immediate contact with the receiver, also for preventing the receiver from rolling when resting upon its side, also to provide a receiver with a yielding member which will act as a cushion for preventing injury to the receiver, also to provide the receiver with a shield for excluding extraneous sounds from the ear, and to act as a protective covering for the receiver.

MAGNETIZING APPARATUS.—J. B. SHERWIN, Butler, Pa. The invention refers to apparatus for transforming bars of iron or steel into permanent magnets, its principal objects being to provide a simple apparatus of this class which may be energized for a limited time by the insertion of a coin or like conducting element. It may be employed as an amusement apparatus and at a profit to the person maintaining it and is also of utility in producing small magnets for various purposes.

Of Interest to Farmers.

HEADER AND SHREDDER.—W. GILES, Amarillo, Texas. In this case the invention relates to improvements in machines for heading and shredding Kafir corn, Milo maize, cane, wheat, and other grain, the object being to provide a machine of this character that may be operated with comparatively little power and that will effectually separate the grain from the stalks without tearing or breaking the bundles.

COMBINED CULTIVATOR AND HARROW.—S. A. WARE, Hyde, Ga. The cultivator is adapted for lateral adjustment, so that the two opposite sets or rows of cultivating-teeth may be placed nearer each other or farther apart, as the conditions of the crop to be cultivated require. The object is to simplify the attachment of the cultivating devices to the beam of the implement and to facilitate the lateral adjustment of the teeth and also to facilitate the insertion of the cultivating-teeth in the removable frame of the sockets.

COTTON-CHOPPER AND WEED-CUTTER.—C. S. SIMMONS and W. N. ROSE, Cache, Oklahoma Ter. The purpose in this improvement is to provide details of construction for a cotton-chopper and weed-killer that may be attached upon the frame of an ordinary corn or cotton cultivator or be mounted upon an individual frame and afford reliable means for cutting off weeds at their roots at the sides of rows of cotton-plants, cut out suckers and extraneous plants between such as are to be left standing, and also stir the soil between such standing plants in a row as the machine is progressively moved along the rows of plants.

LAMP FOR HEATING BROODERS.—G. C. CHASE, Pinehurst, N. C. The object of the inventor is to provide a lamp which is especially adapted for heating brooders, but may also be used for heating purposes in general. Means are provided for preventing the heat of the lamp raising the temperature of the tank above the danger-point; to permit handling of the lamp without spilling the water or other cooling liquid; and concentrating the greatest amount of cooling liquid at the point nearest the source of heat, thus more effectually preventing overheating of the combustible liquid. The chimney is very low and at the same time affords perfect combustion, thus enabling the lamp to be used in a small space.

MILK-STRAINER.—J. O. LINDEN, Prophetstown, Ill. Mr. Linden's purpose is the provision of a strainer and cooler for liquids which is also adapted to act as a cover for a pail or other receptacle. The strainer is especially designed for straining milk, cream, etc.; and also to effectually and quickly cool the same, thereby removing all of the animal heat and odor from the same. The invention also includes a novel form of cooling-tank to be used in connection with the strainer.

ASPARAGUS-CUTTER.—J. O. BOWDEN, Wilmington, N. C. The invention refers to improvements in devices for cutting asparagus from the hills, the object being to provide a device of this character of inexpensive construction, by means of which the individual stalks or shoots may be readily severed from the crown or root without in any manner damaging other roots growing from the crown or breaking the tip of the cut shoot.

Of General Interest.

EARTH-BORING DEVICE.—H. L. ZANDER, New Orleans, La. The principal objects of the invention are to obviate and overcome the disadvantages and objections of hitherto partially successful operations of devices of this character, and to provide earth-boring devices readily operated and controlled. Further, to provide devices by which earth specimens may be obtained from any desired depth of the earth in practically the state of original consistency and geological formation thereof.

BOTTLE AND STOPPER THEREFOR.—A. J. SWAIN, Houghton, Mich. The purpose of the inventor is to provide a bottle and stopper for the same so constructed that after the bottle has been filled and sealed and emptied of its contents it cannot be refilled and again presented as an original package without evidence of the fact being made apparent.

BOTTLE-CLOSURE.—W. H. SHEFFIELD, Hobart, N. Y. The object of this invention is to provide a closure, more especially designed for closing bottles containing milk and like liquids and arranged to properly connect the cap with the bail, to hold the bail on the cap against lateral movement and to permit reuse of the cap by allowing regalvanizing or plating of old caps without danger of disconnecting or displacing the bail on the cap.

SAW-TOOTH TOOL.—T. OLSEN, Manistee, Mich. In this case the invention relates to improvements in tools for operating on the teeth of saws, particularly crosscut-saws, an object being to provide a tool of this character having a part or parts for setting teeth, a swaging part or parts, and a set-gage, thus providing a very convenient and handy tool.

HORSESHOE.—V. PIEDILATE, New York, N. Y. In this patent the improvement refers to horseshoes, the inventor's more particular object being, first, to give the shoe such a construction as will make the same comfortable upon the foot of a horse, and especially where the horse's foot is diseased, and, second, to prevent the shoe from slipping upon the pavement.

SHOE-LACE FASTENER.—SARAH LIPKOWITS, New York, N. Y. The object in this improvement is to provide a fastener or clasp forming an integral part of each flap of a laced shoe or boot and arranged to combine a top eyelet for the passage of the shoe-lace and a clamp for the end of the bow to hold the same at all times in proper position with a view to enhancing the appearance of the shoe on the wearer's foot and to prevent the bow from becoming untied while the shoe is worn.

DUSTER.—LILLIAN MCM. LEA, New York, N. Y. By this invention, when a tube of fabric is mounted upon the handle, it furnishes a convenient and sanitary dusting device which will operate over a large surface. The fabric becoming soiled or dust laden, it may be readily removed from the holder and beaten or boiled to sterilize it. The fabric's loose soft character is such that it readily takes up and retains dust. By the construction great strength and durability are attained, the doubling of the main strips at outer ends of the tube offering necessary resistance to breaking through of the holder, while the tape reinforces the entire structure and with the lines of stitching, prevents its being drawn out of shape or unraveled.

DRAWING INSTRUMENT.—F. E. JENKINS, New York, N. Y. This instrument is particularly designed for describing ovals and other irregular or varying outlines, the object being to provide a tool for this purpose that will be simple in construction, inexpensive, and that may be quickly adjusted for the desired lines and easily manipulated.

PROCESS OF MAKING GLASS.—W. E. HEAL, Marion, Ind. The inventor has as an object in view a process of making window or sheet glass by drawing a tubular sheet of molten glass having two partially-flat sides connected by semi-cylindrical or rounded ends, cutting the cylinder so drawn into suitable lengths, annealing the severed pieces, and cutting away the rounded connecting ends to form a plurality of flat sheets.

GRAVITY-LEVEL.—T. F. DECK, Toledo, Ohio. In the present patent the object of the invention is the provision of a new and improved gravity-level which is exceedingly sensitive and arranged to automatically and accurately indicate horizontal and vertical positions and the angle of deviation when placed out of horizontal position.

STOP-COCK.—R. Y. BUERGER and D. C. BUERGER, Albany, N. Y. This invention has reference to improvements in stop-cocks particularly adapted for discharging a thawing medium, such as alcohol, into a frozen gas pipe, the main object being to provide a stop-cock for this purpose of simple construction, and so arranged as to hold a quantity of liquid ready for instant use and that under any condition or position will prevent the escape of gas.

SELF-FASTENING BUTTON.—E. NOELLE, Ludenscheid, Germany. In the present patent the invention has reference to improvements in self-fastening buttons of that kind which can be attached quickly to the fabric of any part of the clothing or garment without thread and needle stitching and without requiring special appliances for connecting the head to the shank of the button.

Heating and Lighting.

HOT-BLAST STOVE.—F. L. WHITE, Pittsburg, Pa. Mr. White's invention consists in an improved construction of hot-blast stove having in the lower regenerative chamber an improved arrangement of supporting-arches and having the regenerative passages between the upper and lower regenerative chambers formed in a body of novel checker-brick laid so as to break joints and present a bonded structure.

WATER-HEATING DEVICE. — E. J. ROBERTS, Kearsarge, Mich. This invention pertains to means for heating water for lavatory or other purposes, and has for its object to provide a novel simple attachment for a stationary washstand which will enable the instant heating of water by its intimate mixture with steam as the water is drawn into the washbowl for use.

RADIATOR ATTACHMENT.—ELIZABETH L. BOTTS, Butte, Mont. The purpose of the improvement is to provide an attachment to a steam-radiator whereby steam can be conducted to a vessel containing an article or articles of food for the purpose of cooking the same or to a bath-cabinet to introduce steam therein with or without medication. Another purpose is to provide a means whereby the attachment may be readily applied to the escape valve and expeditiously moved without marring the radiator or interfering with its usual functions.

Household Utilities.

SANITARY CLOSET SEAT.—R. L. DEZENDORF, 507 East 87th Street, New York, N. Y. Mr. Dezendorf has received a patent for an improved closet seat and attachments which, on account of the more natural position of the person during its use, is more hygienic and sanitary than ordinary closets. The essential features of the invention are devices, applicable to any closet, for elevating and adjusting the front portion of the seat at any desired angle, whereby the knees of the user are raised in such a way as to bring the weight of the body on the legs and feet, and cause certain muscles affecting the bowels to become more active and efficient than in the ordinary attitudes usually assumed.

We are informed that the improved seat has been approved by physicians and that the patentee is about to introduce it to the trade.

Machines and Mechanical Devices.

WORK-TALLYING DEVICE.—J. H. TIFFT, Eau Claire, Wis. The invention relates to improvements in devices for automatically indicating the number of pieces of work turned out by a machine, the object being to provide a tallying device in connection with a machine that may be set for any predetermined number of pieces of work that it is desired to include in one batch or set and that will cause an alarm or cause stopping of the machine when the required number shall have been reached, thus relieving the machine attendant of considerable responsibility and loss of time.

ORE-CONCENTRATOR.—M. E. PARKS, Torreon, Coahuila, Mexico. Preferably, the inventor employs a rectangular structure, divided interiorly into compartments, respectively, the "concentrator-box," the "tailings-box," and the "slimes-box," the compartments preferably extending full width of the structure and being in communication one with the other. Within the concentrator-box he employs a jigger or screen-box, combined with which is a deflector, said elements being supported in position by special means therefor, suitably mounted above and transversely of the concentrator-box. Special means are employed for imparting a vertically-reciprocating motion to the jigger and deflector.

HAT-MAKING MACHINE.—M. A. CUMING, New York, N. Y. The invention relates to hat-making machines, and admits of general use, but is more particularly adapted for service in such machines as shape or form bell-crown hats of felt, straw, or other fabric and in which it is desirable that the work may be turned out rapidly and uniformly.

FRUIT-PITTER.—A. F. BIEHLER, Hoboken, N. J. In this case the invention has reference particularly to machines for pitting olives, an object being to provide a simple and comparatively inexpensive machine for this purpose by means of which olives may be pitted readily without destroying the fruit in any manner. An attached adding device records the number of olives pitted.

Pertaining to Vehicles.

END-GATE FASTENING.—P. J. HURLEY, O'Connor, Neb. This invention has reference to end-gate fastenings using a transverse tie-rod. The aim is to provide a fastening arranged to prevent the handled nut of the tie-rod from jarring loose, and to permit the operator to quickly unlock the nut whenever it is desired to unscrew the nut with a view to removing the end-gate.

PROTECTOR FOR PNEUMATIC TIRES.—E. LAPISSE, 9 Rue de la Barrière, Elbeuf, Seine Inférieure, France. This protector for pneumatic tires is intended to be located between the covering and the air-chamber and to be independent of these two parts. It comprises, essentially, a strip of soft and elastic material, such as rubber, in which are incorporated strips of heat-insulating material and between the latter a strip made up of metal pieces or chain mail and of an elastic material covering the rings and filling the interstices of the latter.

VEHICLE-BRAKE. — D. BERRY, Fishrock, Cal. The object of this improvement is to provide a brake for vehicles which will be very powerful, be easily operated by foot-power, and capable of release by changing the pressure of the feet of the operator. The brake may be applied upon heavy or light wheeled vehicles of all kinds which will permit the placing of a treadle-lever upon the vehicle-body in front of the seat for the driver who operates the brake and allow a connection of the treadle-lever with the brake-shaft.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 6592.—For manufacturers of presses for molding popcorn.

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Inquiry No. 6593.—For addresses of shingle and saw mills.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

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Inquiry No. 6596.—For manufacturers of rubber novelty goods.

I have every facility for manufacturing and marketing hardware and house furnishing specialties. Wm. McDonald, 190 East Main St., Rochester, N. Y.

Inquiry No. 6597.—For information concerning a "patent gate" for a farm.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc. Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 6598.—Wanted, machinery for making cider, in which a roller process is used instead of hydraulic or screw press method.

The SCIENTIFIC AMERICAN SUPPLEMENT is publishing a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6599.—For manufacturers of gas engines and gas producers for manufacturing plants.

WANTED.—Electrical engineer to take charge of general electrical construction, under chief engineer. Applications by writing only. La Chesnaye, 60 W. 37th St., N. Y. C.

Inquiry No. 6600.—Wanted, a reverse clutch for motor boats.

WANTED.—Colonial silverware. Any one wishing to sell any authentic silver made in this country during the eighteenth century, please communicate with C. A. M., Box 773, New York.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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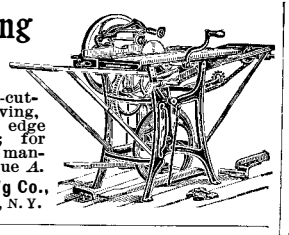
Minerals sent for examination should be distinctly marked or labeled.

(9550) M. M. says: Will you kindly answer by letter the address of all the trade schools outside the one at First Avenue, 67th and 68th Streets, New York, which is filled? A day school where plumber's trade is taught. Please answer as soon as possible. A. The New York Trade School is the only trade school that we are certain has a day course in plumbing. We would advise you to write for catalogues, however, to Pratt Institute, Brooklyn, N. Y.; St. George's Evening Trade School, New York; McAlpin Trade School, New York; Baron de Hirsch Trade School, New York city; Highland Falls Trade School, Highland Falls, N. Y.; North End Trade School, Boston, Mass.; Charitable Mechanics' Association Trade School, Boston; Williamson Free School of Mechanical Trades, Williamson, Pa.; California School of Mechanical Arts, San Francisco, Cal.; Wilmerding's School of Industrial Arts, San Francisco, Cal.

(9551) H. J. H. says: In the physics class recently a discussion arose concerning the direction or directions in which the explosive power of dynamite is exerted. The teacher contends that the explosive force is exerted equally in all directions; the students, that the greater part of the force is exerted in a downward direction. Will you please decide which is correct? If force is exerted in a downward direction, why? Students base their contention on the fact that the textbook says: "Dynamite placed and exploded *on* a rock will shatter the rock." Replying to your question, we would say that your teacher is right; the force exerted by any explosive is one caused by a large volume of gas suddenly liberated, and a gaseous pressure is always exerted equally in all directions. The opinion which you hold is a very common one, which arises from not fully understanding the nature of an explosion. When a large amount of gunpowder placed on the surface of the earth is exploded, a very large volume of gas is suddenly liberated by the burning of the powder. In this case, however, the liberation of the gas is not instantaneous, and there is sufficient time for the gas to escape upward into the atmosphere before the pressure, which acts equally in all directions, is sufficient to greatly affect the surface on which the gunpowder was set off. If the powder could have been burned ten times as rapidly, the same amount of gas would have been liberated; but because it was liberated more rapidly, the pressure would have been many times greater, and sufficient in all probability to scatter the earth or rock beneath it in all directions. When dynamite is exploded, exactly the same effect takes place, excepting that in the case of dynamite, the gas is liberated almost instantaneously. In this case there is not time for the gas to escape upward before such an enormous pressure is exerted in all directions that whatever is near it, either above or below, is shattered.

(9552) J. K. says: 1. I want to make a sounding box 10 inches in diameter and 4 inches high. What material should I use, and of what thickness for top, bottom and sides? A. A sounding box may be made of any kind of wood, excepting the part which gives the resonance. This should be made of clear pine or spruce, very resonant woods. The resonant side may be from an eighth to a quarter of an inch, depending upon the kind of instrument upon which it is put. No general answer can be given. The back and belly of a violin are not usually as thick as an eighth of an inch. 2. What is meant by tensile strength? When the quantity of lumber is expressed in feet, which is meant—square or cubic feet? A. Tensile strength is the force required to pull open a wire or bar or rod of any given material, when the piece has a section of a square inch. When lumber is given in feet, the square foot or superficial foot with a thickness of one inch is understood. Thus a plank two inches thick has twice as many feet in it as a piece one inch thick. 3. Why is it that a locomotive with 1,500 or probably little more horse-power can attain a speed of 80 or 85 miles an hour, with a train of 250 or 300 tons, whereas a racing automobile with 90 horse-power and weighing about 3,500 pounds, which represents a much greater power per pound of weight moved, attains only the same speed as the locomotive does, and in some cases even smaller? A. The statement of the speed of automobiles hardly represents the latest records. However, the locomotive has the momentum of the heavy train to help it. A light weight cannot be given so great a velocity as a heavy one. A very light ball cannot be batted so far nor sent so fast as a heavy ball.

Wood-working Machinery



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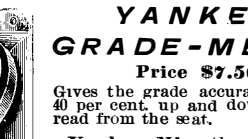

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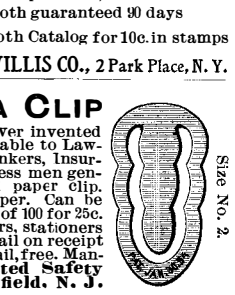

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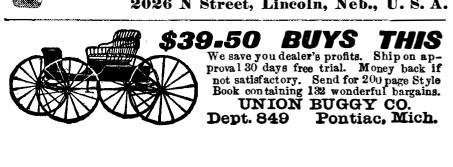

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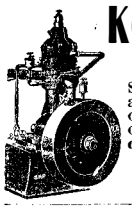

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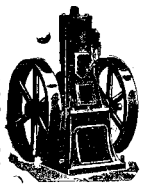

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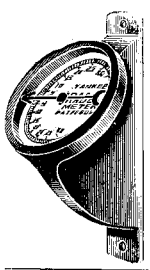

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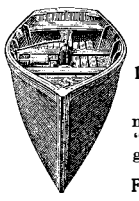

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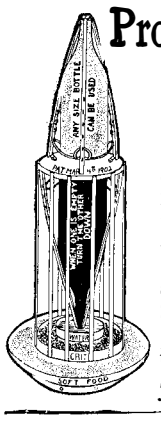

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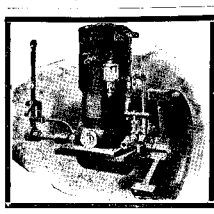

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NEW BOOKS, ETC.

SMALL ELECTRICAL MEASURING INSTRUMENTS. How to Make and Use Them. London: Percival Marshall & Co., N. D. 16mo.; pp. 90. Price, 20 cents.

This little book will prove useful to amateurs. The diagrams are clear and the descriptions lucid.

ELECTRICITY CONTROL. By Leonard Andrews, Assoc.M.I.C.E., M.I.E. Philadelphia: J. B. Lippincott Company, 1904. 8vo.; pp. 231; 204 illustrations.

This book is devoted exclusively to the systems of electric transmission and switch gear between the generators and the distributing center. Starting with the general principles of switch gear design, the author discusses its constructional details in the form of circuit breakers, alternating reversing current devices, and the arrangement of bus bars and other apparatus for parallel running. The general arrangement of controlling apparatus for both high and low tension systems is also gone into and examples of complete installations of both types are given. Long distance transmission schemes are also discussed, and the insulators, lightning arresters, etc., used on such lines are thoroughly described. Numerous half-tones and line cuts illustrate the text in a thorough manner. The book will be found most useful by electrical engineers who have to deal with this subject.

THE NAVAL CONSTRUCTOR. By G. Simpson, M.I.N.A. New York: D. Van Nostrand Company, 1904. 16mo.; pp. 588; numerous diagrams and tables. Price, $5.

This handbook is one of the most complete works of ready reference for those engaged in ship design, construction, or maintenance that we have seen. A great deal of valuable information on most points in the theory and practice of marine architecture will be found in its pages in very concise form, while besides this there is much new matter that will be found useful, such as the chapter on design and many of the tables of standardized fitting details. The freeboard tables have all been explained and their application has been simplified by the working out of examples of the various types to which freeboards are assigned. Among these types are the modern shelter decker, rules for which have recently been issued. All obsolete matter and data have been eliminated and the book is entirely up-to-date and thoroughly practical in its character. A large number of valuable tables are contained in its latter pages.

TASCHENBUCH DER KRIEGSFLOTTEN VI. JAHRGANG 1905. Mit teilweiser Benutzung amtlichen Materials. Herausgegeben von B. Weyer, Kapitänleutnant a. D. 359 Illustrations. München, 1905. J. F. Lehmanns. Price, $1.50.

The stirring events in the Far East, events which are of considerable importance in naval annals because of the destruction of Russian and Japanese ships, has rendered it necessary for Capt. Weyer to revise his excellent little manual with considerable care. The book as it now stands takes into consideration the losses that have been sustained by both combatants up to December 10, 1904, and may, therefore, be considered the most thoroughly up-to-date naval manual now to be obtained. About fifty pictures and drawings have been added to this year's book, which have contributed much to the value of the work. In order to make room for these, a few unimportant chapters on signals and information relating to government officials have been dropped.

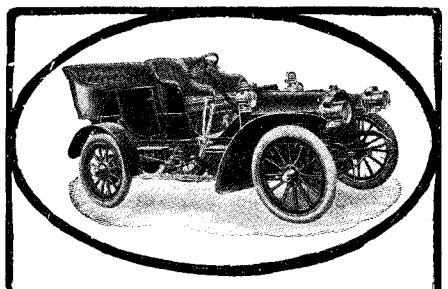
INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending February 28, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abrading implement, Edwards & Williams	783,937
Accounts, means for entering, R. C. Williams	783,738
Acids from solutions, apparatus for the recovery of volatile, E. R. Hewitt	783,783
Advertising device, Redpath & Corbitt	783,542
Air brake, J. Riley	783,801
Amusement apparatus, U. Ancillotti	783,812
Angle joint, J. D. Walsh	783,987
Armatures for dynamos with wave-winding, equipotential connections for, Arnold & Collischonn	783,498
Bag turning machine, W. H. Lester	783,443, 783,444



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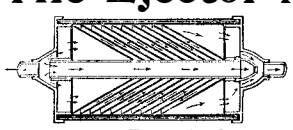

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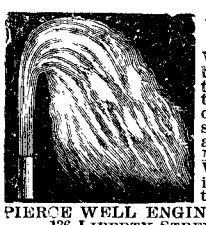

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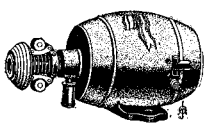

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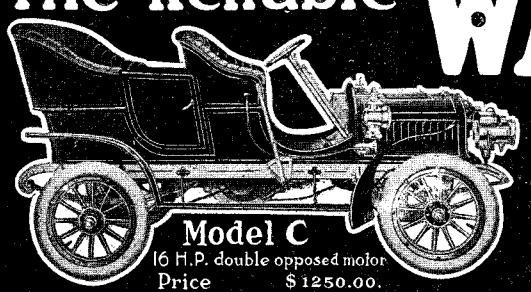

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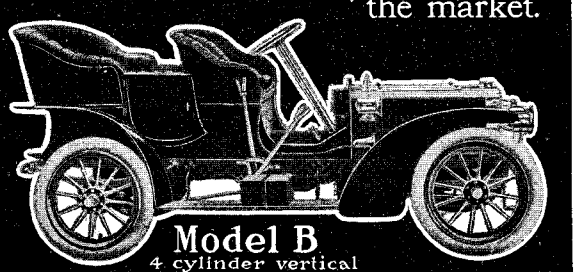

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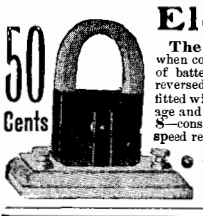

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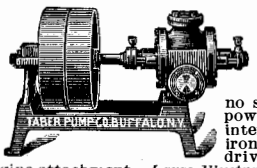

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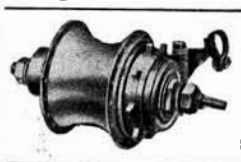

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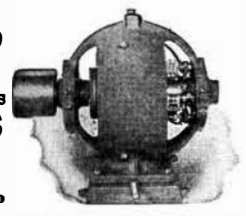

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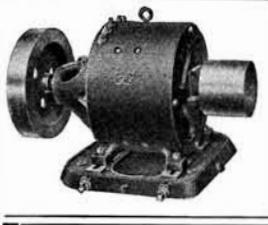

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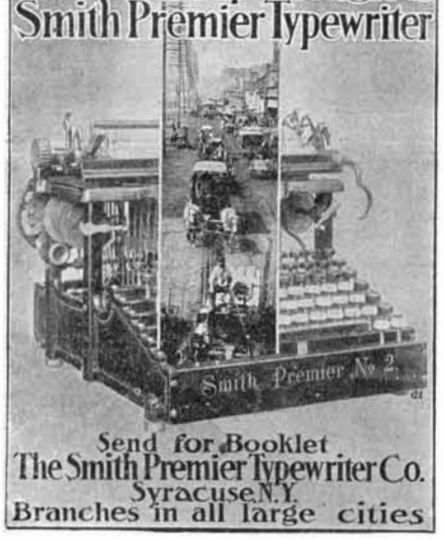

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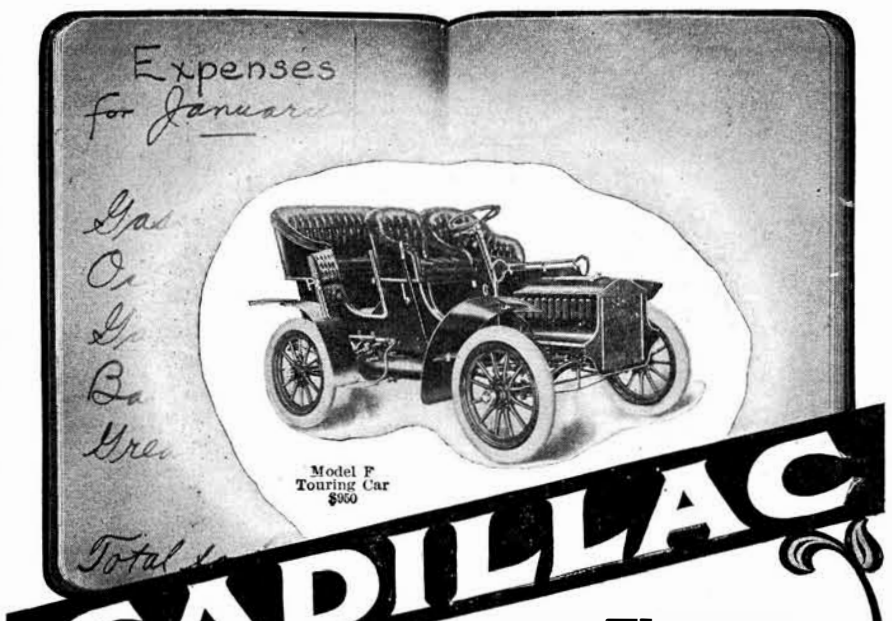

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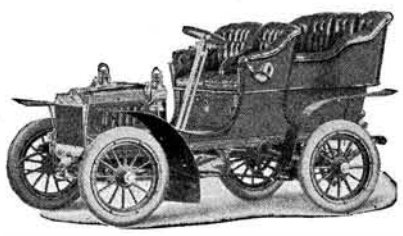

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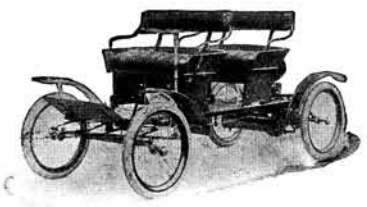

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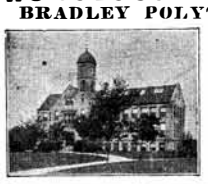

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